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RBORETUM BULLETIN

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Concerning this issue. . .

As winter turns to spring, although by fits and starts, trees bud and burst and bloom! So we are featuring trees, trees, trees—the enduring oaks, vigorous alders, and two special maples.

Dr. A.R. Kruckeberg describes his favorite Pacific Northwestern oaks, some shrubby, some stately. These are particularly for use as ornamentals in our gardens.

Brian Mulligan begins a two-part survey of the alders in the Arboretum. In this issue, he discusses European and North American species. Learn about the alders which are so abundant in this region!

Another tree abundant here is the bigleaf maple, *Acer macrophyllum*. Marvin Black, Seattle City Arborist, has had a change of heart about this tree, and praises it as a component of landscapes. Read on to see why . . .

And while we are discussing maples, don't forget a trip to view the gorgeous striped-bark maple, *Acer tegmentosum*, which can be seen in our Arboretum.

Our central article features the first installment of Jeanne Gardiner's plant-exploring trip to Tibet. We are given a fascinating tour of China, and are left poised on the very threshold of Tibet itself.

For those who have already been picking spring flowers, Dr. Meeuse provides a lively discussion of some factors important to flowers in the vase, and also describes some intriguing events that follow pollination in certain flowers.

May you all enjoy the sunshine and mists of the rest of spring.

SUSAN LIBONATI-BARNES

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ARBORETUM BULLETIN

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COVER

The trunk of the striped-bark maple, *Acer tegmentosum,* in the Arboretum (see page 15).

Photo: Brian O. Mulligan

Events of Interest

FOURTH THURSDAY WEEDERS' DAY is the volunteer maintenance program in the Arboretum. Come and weed, bring a few tools and join other friends of the Arboretum on June 24 and July 29, 10 AM, at the Arboretum Office.

SUNDAYS IN SPRING: SUNDAYS AT ONE. On June 6 and 13, two-hour public tours of the Arboretum will be offered by Arboretum Guides. Meet at 1 PM in the parking lot of the Arboretum Office.

EXPLORERS' WALKS. For a two-hour tour of the Arboretum, come on June 8 and 23, July 28, and August 25. No appointment is necessary, and admission is free. Meet in the parking lot of the Arboretum Office at 10 AM. (Wear adequate footgear, even in warm weather.)

PUBLIC LECTURE: LEGUMINOSAE IN THE ARBORETUM. This lecture by Jan Pirzio-Biroli, Arboretum Naturalist, on Wednesday, June 16, is free and open to the public, but space is limited. Call 543-8800 for reservations.

TENTH ANNUAL FERN SALE, sponsored by the Northwest Ornamental Horticultural Society, will be held June 25 (Friday), 10 AM—9 PM, and June 26 (Saturday) 10 AM—4 PM, at Crossroads Mall, 156th Avenue NE and NE 8th Street, Bellevue.

Don't forget that the ANNUAL MEETING AND DINNER OF THE ARBORETUM FOUNDATION BOARD OF DIRECTORS will be held Wedneday, June 9, at the Seattle Yacht Club, 1807 East Hamlin, Seattle.

NATIVE AMERICAN WEAVING. An exhibit of Native American weaving from the Northwest Coast and the Sahaptin tribes of the Plateau, will open in July at the Thomas Burke Memorial Washington State Museum. The exhibit, sponsored by the National Endowment for the Arts and by the Handweavers Guild of America, will feature exemplary traditional works and their tools of manufacture. There will also be a program of lectures and demonstrations. Call 543-5590 for further information. The hours of the Museum are 11 AM—5:30 PM Tuesday through Friday, and 9 AM—4:30 PM on weekends.

THE FIFTH ANNUAL NATIVE PLANTS, NATIVE AMERICANS exhibit will be on view at the Burke Museum, Tuesday through Sunday, June 1—6. This free exhibit features more than 100 live plant specimens, photos and artifacts from the Olympic Peninsula, Cascade Mountains, the dry foothills and the desert. Eugene Hunn, ethnobiologist from the University of Washington, and Helen Norton have prepared the exhibit. There will be detailed labels with the scientific, common and Indian names of the plants, and the traditional, utilitarian and medicinal usages of them. Attend early to see the plant specimens in their prime! See above for Museum hours.

BONSAI SHOW, admission free, will be held from Friday, June 4, through Sunday, June 6, at the Burke Museum. Call 543-5590 for further details.

Lithocarpus densiflorus forma attenuato-dentatus, the rare cut-leaved mutant of tan oak (page 5); 2/5 natural size.
Photo: A.R. Kruckeberg

The Ornamental Oaks

Evergreen Species Native to the Pacific Northwest

*ARTHUR R. KRUCKEBERG**

Note: Mature specimens of most of these evergreen oaks in a civilized setting can be seen at several places in the Seattle area. The most complete collections are at the Carl S. English, Jr. Gardens at the H.S. Chittenden Locks, Ballard area, and at the Washington Park Arboretum. A particularly fine specimen of Quercus chrysolepis *is near the southeast corner of the Music Building, University of Washington Campus. And the garden of the MsK Nursery grows all of them, including the rare cut-leaved mutant of tanbark oak.*

The time has come to nudge our native evergreen oaks out of the connoisseur's market, for they richly deserve wider use in Northwestern gardens. Time was when only friends and patrons of Carl English, who pioneered so many fine introductions of natives, had access to these evergreen gems. Although native oaks are still not common commercially, a few nurseries do stock them; demand should increase the supply. And what a reward for the gardener when specimens from the nursery begin to flourish in the garden!

What makes our native evergreen oaks so special? Old-world species like Holm oak (*Quercus ilex*) and cork oak (*Q. suber*) have long proved themselves in horticulture—and in the corking of viticultural output! So the special worthiness of our native evergreen oaks should not be unexpected. First off, good broadleaved evergreens are always prized in the garden; just think of hollies, rhododendrons, and other ericaceous evergreens that display elegant textures and shapes of leaves—

*Professor of Botany, University of Washington, Seattle, WA, 98195. Portions of this article are taken from the author's book (Kruckeberg, 1982), by permission of the University of Washington Press, Seattle.

foliage that lasts all year. But our native evergreen oaks seem to have a unique set of commanding qualities: superior habit of tree or shrub and of branching pattern, elegant twiggery with lustrous green leaves, and a distinguished set of leaf traits such as venation, margin, texture and shape. Such vegetative elegance need not be topped with bloom or fruit to gain the admiration of gardeners. Hence, oaks in fruit always provide an added element of beauty; some of those described below fruit copiously in local gardens and are showy in their fecundity.

I will describe in detail three forms of tan oak (*Lithocarpus densiflorus*) and three species of evergreen oak in the genus *Quercus*; all are members of the family Fagaceae. Be aware that by assigning these native to the Pacific Northwest I do not mean to say that they occur in the wild in Washington state. Biogeographers embrace northern California to southern British Columbia as the biotic province we know as the Pacific Northwest. The oaks I tempt you with here are largely from northern California and southwestern Oregon, but are quite hardy in the Puget Sound region and elsewhere west of the Cascade Range. Extended accounts of them can be found in Kruckeberg (1982).

The tan oak tree, *Lithocarpus densiflorus*; 1/2 natural size. Photo: A. R. Kruckeberg

Tan Oak, *Lithocarpus densiflorus*

Though this exquisite broadleaved evergreen barely gets into the Northwest, it must be included as one of our most desirable ornamentals. Its superb foliage and bold specimen profile lend unique character to any garden.

Most oaks are in the genus *Quercus*. But tan oak or tanbark oak is placed in a separate but related genus in the family of oaks, beeches and chinquapins (Fagaceae). Unlike typical oaks with their pendent male-flowered catkins borne back from the tips of twigs, *Lithocarpus* has stiffly erect male catkins that emerge in clusters from the tips of branches. Sudworth (1908) says of it: "[*Lithocarpus densiflorus*] is the connecting link between oaks and chestnuts." Tan oak ranges northward in the Coast Range from central California to the Umpqua River drainage of Oregon. In our province it is mostly associated with Douglas fir and mixed conifer-hardwood forest, along major river drainages.

Distinguishing features. In the wild, tan oak can reach 50 to 80 feet; garden specimens rarely exceed 25 to 30 feet tall. The slender trunk is seldom straight; it may often be buttressed, with a flaring base. Single, open-grown trees have a broad crown with large, horizontal limbs. The trunks have a smooth bark, often broken into large plates by thin deep seams.

Tan oak foliage has unexcelled character. Mature leaves are thick and leathery, with shallowly toothed margins and bold, straight, lateral veins. When young, the leaves and twigs are coated with a fine down of star-shaped hairs. Male flowers grow in erect spikes, clustered at the ends of twigs and are creamy white; the one to two inch long acorns develop singly or in pairs at the base of the male catkins, and are in shallow cups beset with recurved, pointed scales.

Ornamental value. Tan oak is such a strikingly beautiful evergreen that it will command admiration in any choice garden spot. As it is shade-tolerant in nature it will take to partial shade in the garden setting. For the small garden it should be planted to give it room to grow as a single specimen tree, where its tannish gray-green foliage can lend contrast to the dark greens of conifers, rhododendrons and camellias. For larger spaces, a grand

effect can be developed by planting groves or drifts of the tree rather widely spaced (10 to 15 feet apart) in groups of uneven number.

Though only reaching southern Oregon in the wild, this tree has proved hardy as far north as Seattle; only the freeze of 1955 cut it back. It, like most other broadleaved evergreens, cannot take the winters east of the Cascades. Tan oak is a robust tree with ample, dense foliage and thus can be a permanent source of decorative greenery. Every time there is a festive occasion at our house, in come the sprays of this bright and bold foliage. It is a perfect foil for cut coniferous evergreens.

There are two choice varietal forms of tan oak, both originating in the wild. *Lithocarpus densiflorus* var. *echinoides* is a spreading shrub reaching six to ten feet tall, with soft gray-green foliage (see below). The other variant is almost unknown in cultivation as yet, and is rare in nature. It is so unlike *Lithocarpus densiflorus* that it took the oak specialist, Dr. John Tucker, to place it with the tan oaks. This arborescent shrub or small tree has deeply dentate, almost dissected, narrow leaves, the marginal teeth bearing slender spines. Dr. Tucker calls the plant *forma attenuato-dentatus*. We were fortunate in getting cuttings established from specimens sent from the type locality in northern California. This form has become a collector's item since it has been only sparingly propagated.

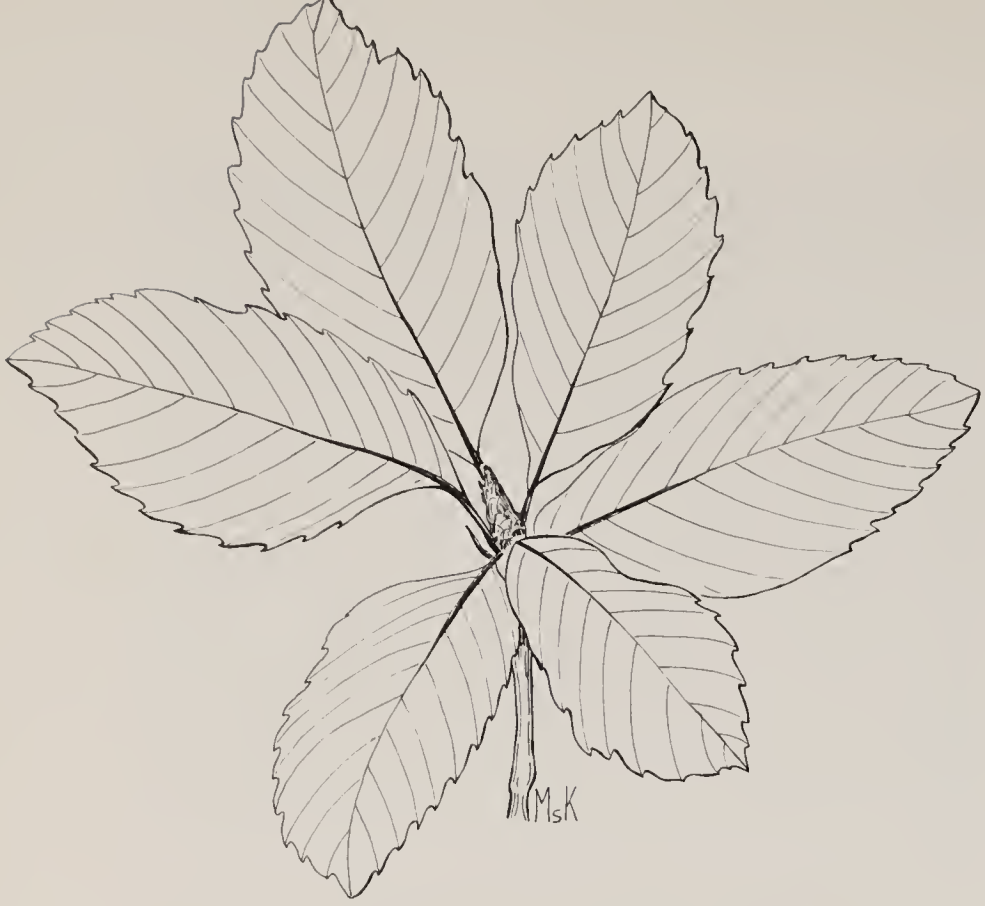
To David Douglas goes the honor of having discovered the magnificent tan oak tree. On an exploring trip in the 1830's into central California he encountered the tan oak, and sent dried specimens back to England. It was Professor Sargent of Harvard University who introduced tan oak to the garden; plants of his introduction of 1874 are still in the oak collection at the Royal Botanical Gardens, Kew, England.

Canyon Live Oak, *Quercus chrysolepis*

Of the three evergreen broadleaved trees with oak affinity in the Pacific Northwest, only canyon live oak is a member of the oak genus, *Quercus*. This magnificent evergreen reaches its northern limit in southwestern Oregon. It thrives in open woods and canyons of the major drainages of the coastal mountains in Douglas, Josephine and Curry counties. Southward, it reaches across the entire length of California and just beyond into Baja California. No one description will suffice for such a variable tree. In habit it may be no more than a tallish shrub in the drier portions of its range, while in moist canyons and lower wooded slopes it can reach nearly 100 feet in height. The foliage is equally varied in texture, color and toothing of leaf margin. Despite the variety of forms taken by canyon live oak, the gardener can depend upon the leathery-textured leaves of contrasting hue—glossy green above, grayish green beneath—on a framework of exquisitely branching form.

Distinguishing features. Canyon live oak is a small to large evergreen tree, accommodating in form to a variety of habitats. Color, texture and toothing of leaves vary widely. Young leaves are yellow-green with a soft golden fuzz beneath. Older leaves may be bluish green (due to a glaucous "bloom") or glossy dark green and dull white beneath. Leaves are one to two inches long and up to 3/4 of an inch wide, broadly lance-shaped, and usually pointed at the tip. The leaf margin is bewilderingly variable. Some trees have

Two foliage types of *Quercus chrysolepis:* holly-leaved above, entire-leaved below; 1/4 natural size.
Photos: A.R. Kruckeberg



Sadler oak, *Quercus sadleriana;* 1/2 natural size.
Drawing: M.S. Kruckeberg

leaves with entire margins throughout; others are wholly spine-toothed like holly leaves; and still other individual specimens have both entire and toothed leaves. Such variability of leaf margin—entire to toothed—is reminiscent of English holly.

In the wild, canyon live oak produces copious amounts of acorns in good seed years. The acorns are 1/2 to one inch long, buff-colored and set in golden brown cups.

Garden uses. Canyon live oak can be grown singly or in groups of widely spaced specimens. As hedge plants trimmed specimens tend to produce spiny-margined leaves. Canyon live oak will take to almost any garden exposure but an extremely shady and wet one. In the Puget Sound area and other coastal localities, it grows best in sunny exposures, retaining a dense rounded form of medium height. It is best to use plants that come from the northern portion of the natural range in order to ensure hardiness in the Northwest. In colder areas west of the Cascades, the tree takes well to planting against a warm wall, its foliage blending with fine effect against brick, rock or natural wood. Of all our native broad-leaved evergreens, this one is the most likely to be available in nurseries, especially those specializing in native plants.

SHRUBBY EVERGREEN OAKS

Sadler Oak, *Quercus sadleriana*

Shrubby evergreen oaks are in great demand currently, and as long as acorns set, we can be assured of a supply of them. Though it may be arbitrary to pick favorites among our three natives, *Quercus sadleriana* would rank high on anyone's list. Deer oak or Sadler oak (*Q. sadleriana*) is a six to ten foot high, spreading evergreen or semi-evergreen. It forms dense thickets in open coniferous forests and dry open slopes in the Klamath-Siskiyou mountains from northeastern Curry County, Oregon into northern California. The lustrous, rich-green leaves are unusually large for an evergreen oak: two to four inches long, broadly oval, toothed and with dominant lateral veins. Mature specimens flower and fruit handsomely in cultivation.

Partial sun at the edge of a conifer canopy or in a moderately sunny shrub border suits Sadler oak best.

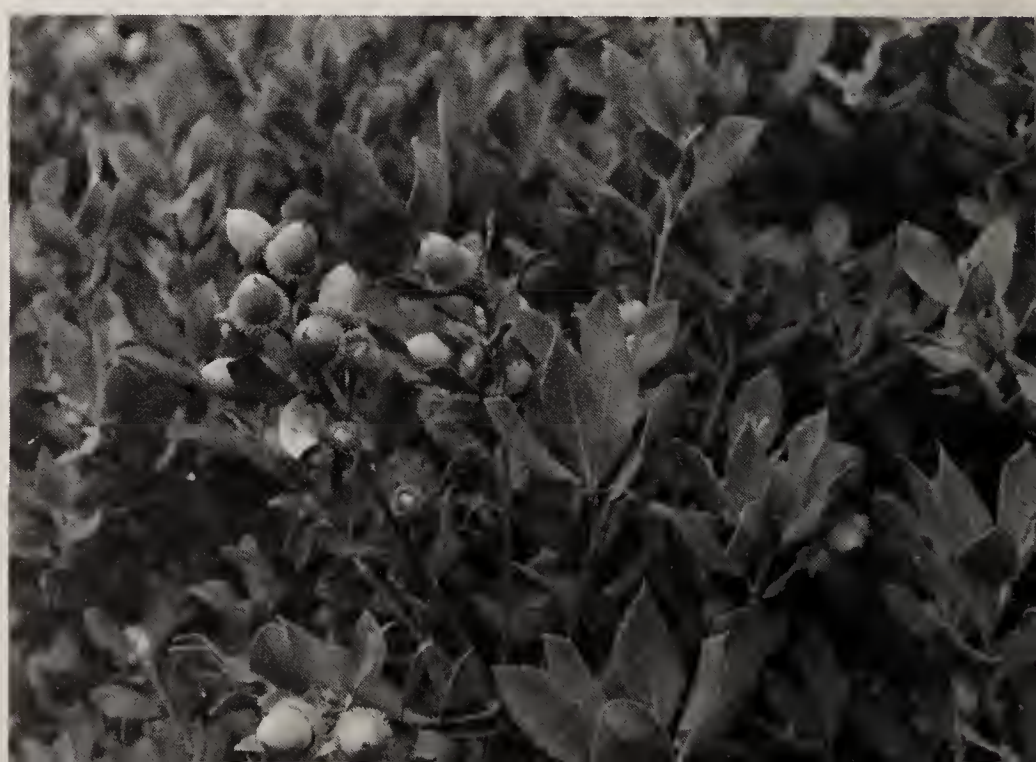
Huckleberry Oak, *Quercus vaccinifolia*

Though sometimes considered a shrubby variety of canyon live oak, it seems best to recognize as a unique species this distinctive and handsome low shrubby evergreen oak. While huckleberry oak is commonest in the granitic slopes of the high Yosemite country of California, it is locally plentiful in places in the Siskiyous as far north as southern Josephine County, Oregon. Here it likes dry open brushy slopes, often growing on serpentine (high magnesium) soils.

Huckleberry oak is a low and compact shrub up to four feet high, with small, mostly entire, ovate to lanceolate leaves. It thrives on a south-facing slope; the drier portions of a rock garden make good habitats.

Mention should be made of another low-growing evergreen oak, even though its natural range is just south of our area. The leather oak, *Quercus durata*, reaches northern California in Trinity County and so should be fairly

***Lithocarpus densiflorus* var. *echinoides*, the bush tan oak; 1/8 natural size. Photo: A. R. Kruckeberg**



hardy in our more northern gardens. We have found it perfectly hardy in Seattle, and have admired its fine gray-green holly-like foliage for years. *Quercus durata* in the wild is almost wholly confined to serpentine soils.

Shrub Tan Oak or Dwarf Tanbark, *Lithocarpus densiflorus* var. *echinoides*

In all but the technical features of flower and fruit, the tanbarks are good oaks. And this one, the shrubby variety of the tree-sized tanbark, ranks high among the gardener's choice showpieces. The gray-green foliage clothes a shrub of three to five feet in height; the oblong leaves are mostly two to three inches long, smaller than those of the tree form of the species. The finely stellate pubescence disappears with age to reveal bold lateral veins; the leaf margin is entire or obscurely toothed. Like its tree version, shrub tanbark bears its flowering catkins stiffly erect at the tips of branches. Dwarf tanbark likes the sterile open brush-covered slopes of serpentine soils in southwestern Josephine County, Oregon, often growing with huckleberry oak. It ranges south into California on serpentine, both in the Siskiyou-Klamath country and down the Sierra Nevada to Tuolumne County.

Find a moderately sunny, well-drained spot in the garden for this prized plant to thrive. It is perfectly hardy in the western sections of the Northwest.

PROPAGATION

All these oaks are sparingly available in speciality nurseries around the Northwest. Should the impatient gardener not locate certain ones in the trade, they can be easily started from seed.[1] The only precautions are to sow *fresh*, viable acorns. They should be planted soon after they are harvested in late summer or early fall. Since "mighty oaks from little acorns" start out with strong, fast-growing taproots, it is well to sow the acorns in deep flats. The planting mix can be pure peat, vermiculite, or perlite, or a mix of equal parts perlite, peat and compost. A few dealers sell seed; order and plant them in the fall!

Collecting your own acorns of these evergreen natives can take you to delightful places in the rugged Siskiyou country of Oregon and northern California. If you plan to be home in a few days, collect the acorns in paper sacks, not plastic bags (they foster mold!). Some professionals, like Carl English, put the acorns in barely moist peat just as they are collected in the field. They will germinate in 30 to 60 days. Lest this optimism for growing oaks from acorns be unfounded in practice, let me anticipate the only major pitfall. Acorns are often infested with weevils; look for the telltale tiny hole and the empty "feel" of the seed. Fortunately, there is always a "Darwinian" mix of good and bad acorns. Oaks from seed are slow to reach garden maturity. But your patience will be greatly rewarded; these native evergreen oaks rank high in the royalty of our hardy broadleaved evergreens.

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Schopfmeyer, C.S. 1974. Seeds of Woody Plants in the United States. Agriculture Handbook No. 450. Forest Service, U.S. Department of Agriculture, Washington, D.C.

Sudworth, G.B. 1908. Forest Trees of the Pacific Slope. Forest Service, U.S. Department of Agriculture, Washington, D.C.

Huckleberry oak, *Quercus vaccinifolia*; 3/4 natural size.
Drawing: M. S. Kruckeberg

[1]The book by Schopfmeyer (1974) has illustrations of the acorns on pp. 513 and 696-697, as well as good accounts of how to germinate them.

Announcements from the Unit Council

THE UNIT COUNCIL presented Joe Witt with a gift of $8,000 from the proceeds of the 1981 fall bulb sale, to be used in the Arboretum at his discretion.

The Arboretum Foundation Executive Board has decided to close out its book department. Orders will no longer be accepted. The combination of expense and time commitment has made this necessary. We will always be indebted to Loretta Slater for her years of volunteer service as our "book lady," and also to those who preceded her.

The HORTICULTURE EXHIBIT in Southcenter was held in March. The displays were beautiful and most informative. Many thanks go to Suzanne Wilson and her many helpers. This has become a very popular and well received annual event.

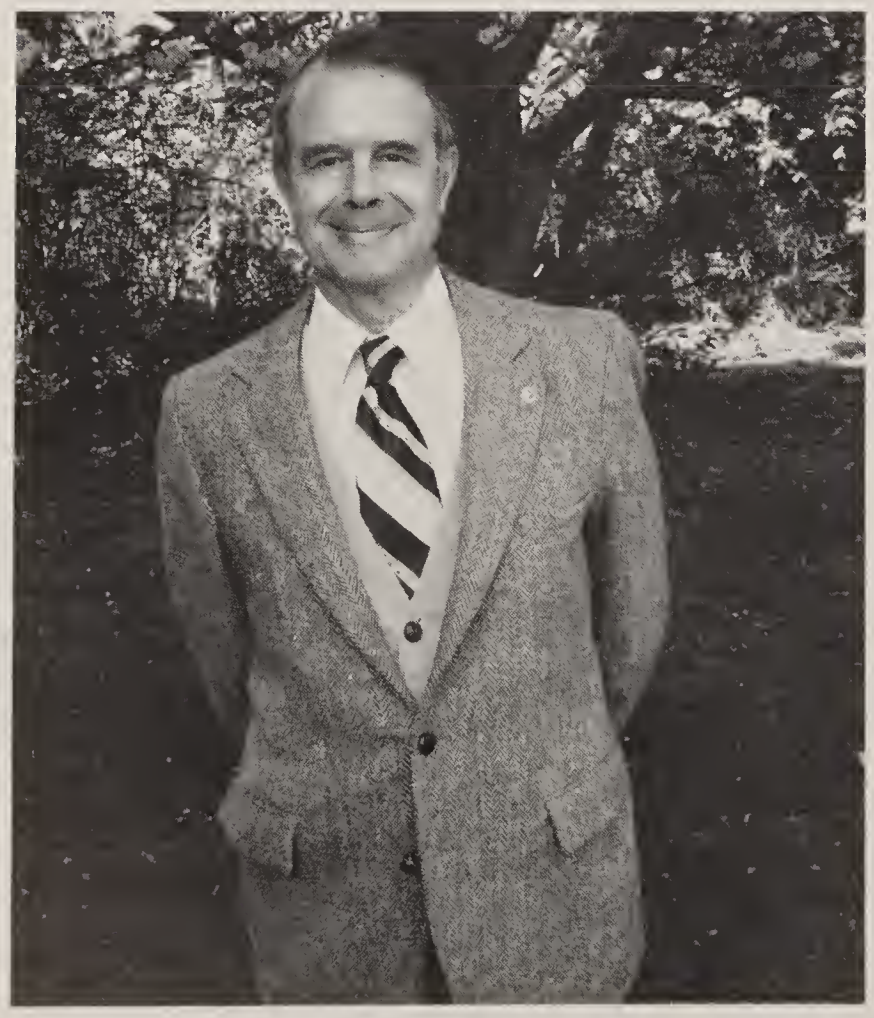
New Officers for 1982-83

First Vice-Chairman, Membership	Barbara Anderson
Third Vice-Chairman, Greenhouse	Arlene Sourbeer
Finance	Karole Kiefer
Secretary	Chris Anderson
Assistant Secretary	Lesley Norton

SHEILA TAFT

Joseph A. Witt, Research Professor

Readers of the *Arboretum Bulletin* will be pleased to know that the Board of Regents of the University of Washington has approved the promotion of Joseph A. Witt to Research Professor in the Center for Urban Horticulture effective July 1, 1982.



Witt received his B.S. and M.S. degrees from Washington State University and did additional graduate work at the University of Washington. He joined the Washington Park Arboretum in 1948 serving as Botanical Recorder, Assistant Director, and currently as Curator of Plant Collections. He is a well-known authority on woody plants of the Pacific Northwest and has lectured on plant materials before almost every horticultural organization in the area. In 1972, Witt served as national president of the American Association of Botanical Gardens and Arboreta and he is a frequent contributor to the *Arboretum Bulletin*. Joe's many friends join in wishing him our heartiest congratulations.

H.B. TUKEY

Color changes in the orchid *Cymbidium* cv. 'Camelot': the flower on the right is unpollinated; in the flower on the left, three days after pollination, the labellum has darkened noticeably (page 11).
Photo: Tom Boyden

A Posy for a Friend—

Cut Flowers and Post-pollination Phenomena

B.J.D. MEEUSE

Editor's Note: We now feature another interesting article on plant physiology, from the desk of Dr. Meeuse, Department of Botany, University of Washington, Seattle. Dr. Meeuse discusses some factors important to cut flowers, and treats us to a lively narration concerning the effects of pollination in several species.

CUT FLOWERS

How do we keep cut flowers in good shape over as long a period as possible? A practical person would point out that this problem transcends the personal, and has become one that is studded with glittering dollar-signs: the export of cut flowers from Hawaii, California, Colombia and Israel has become a multi-million dollar industry!

In dealing with the problem of floral longevity, there are some very elementary do's and don'ts.

First of all, one must, of course, avoid the most ephemeral flowers, such as morning-glories. Some of these are known as "day flowers," for very good reasons: they really do not last much longer than twelve hours. Other examples are the flowers of evening primroses (*Oenothera biennis* and *Oenothera hookeri*), which essentially last for only one night and part of a day, and spiderworts (*Commelina* and *Tradescantia*). These species do provide excellent material for the study of senescence.

Secondly, it goes without saying that it is a good idea to start out with flowers that have just begun to open, or even with buds. Not only do these still have their whole career as a flower before them, they may also escape the life-shortening experience of pollination, which

we shall discuss in detail below. An added bonus is that the human recipient can have the inspiring experience of seeing a bud or flower unfold. In passing, we mention that some flowers treat us to this spectacle on a number of successive days, as discussed in our *Arboretum Bulletin* 42(2):29, Summer 1979.

It is remarkable that the buds of certain commercially important flowers such as carnations and baby's breath (*Gypsophila paniculata*) may stubbornly refuse to open in cut-off material. Fortunately, solutions to force opening have now been developed in both California and Israel. (In *Gypsophila*, Physan-20, a so-called quaternary ammonium compound, has proved to be very effective when given as a 200 parts per million solution in combination with sucrose. For carnation buds, Israeli workers have developed the so-called ZH-solution, which contains glycolic acid, hydroxy-quinoline and sodium benzoate.)

A third point to keep in mind is: good water relations. We do not want our vase flowers to wilt! Ideally, their cells have to be like inflated little balloons, and since it is water that inflates them, the ability of the cut stems to transport water has to be maintained. It is also good to provide sugar, since that helps the cells to attract water, while at the same time it acts as "fuel" to support good cellular respiration. Practices such as cutting off the flower stems under water (which prevents the formation of gas bubbles in the plant's water-transporting vessels) help to maintain a steady stream of fluid from vase to flower.

A factor that is often overlooked in this is *water loss*. Its importance can be demonstrated very convincingly by taking two florets of stock and putting the cut petioles in vials of water, after which one is covered with a bell-jar to prevent air-exchange (with concomitant water loss) while the other is left uncovered. The result is that the bloom under the jar will become half again as large(!) as the other one, and will also last longer—provided, of course, that the blossom is not attacked by molds or bacteria. An abundance of such micro-organisms in the vase-water would result in the plugging up of the stem's transport-system, and that is the rationale behind the use of microbe poisons. At an early stage in the study of flower-longevity, it became clear that silver nitrate is very effective as a biocide. In carnations and chrysanthemums, the vase life can be extended considerably by immersion of the cut stems for 10 minutes in a 1,000 parts per million solution of the silver nitrate.

In *Gladiolus*, such treatment also increases the percentage of buds that will open. In several flower species, the effectiveness of the silver impregnation is enhanced by sugar. Solutions of silver nitrate have an acid reaction, and their effectiveness against microbes may, in part, be due to that fact. Citric acid and some other plant acids have also been used successfully. Later on in the article, however, we shall see that a major advantage of silver nitrate over other compounds is that it ties up ethylene—which, in the drama of flower senescense, is one of the major villains.

A fourth guide-line is to avoid making gifts of flowers that have been pollinated. Dramatic examples of the effects brought about by pollination are found in the orchid family, where many species rely on the services of just one, very special, pollinator-species. If the animal is not common, the orchid flowers may have to "wait" for weeks on end before pollination and fertilization will occur, and during this whole period they remain in exquisite shape. This may well be the reason why orchid flowers are such sought-after commercial items. It is only after they have been pollinated that they lose their splendor—and fast! One can see why a pollinating bee or bumblebee in an orchid house is definitely a *persona non grata*, greeted with as much enthusiasm as the proverbial bull would be in a china-shop! A good illustration of the situation is provided by certain species of *Ophrys*, terrestrial orchids from the Mediterranean region and Europe. Their flowers bear a striking resemblance to the females of certain bees and wasps, both in visual appearance and odor, and for this reason they will attract the males of these insects, which will then try to mate with the flowers, with pollination as the result. Usually, the orchid flowers appear on the scene some time before the male wasps or bees do, and long before the females have hatched. In this way, there is a good chance that they will get the attention of the males. Once the flowers have been pollinated, they become unattractive very fast. Although the "pseudocopulation"-phenomenon

we have just described is very rare, there are many tropical orchids which display an equally high pollinator-specificity. It is, therefore, not at all surprising that it is *their* flowers that have provided us with choice "guinea-pigs" for studying from A to Z the fascinating post-pollination phenomena that follow the artificial pollination carried out at a moment of *our* choosing. Dr. Joseph Arditti and his co-workers at the University of California in Irvine have produced a whole series of articles on the post-pollination phenomena in *Cymbidium* orchids; elsewhere, interesting work has been done on *Vanda* and some other orchid genera.

POST-POLLINATION PHENOMENA

The question may well be asked why we bring up the matter of post-pollination phenomena when we started out by saying that we should avoid presenting pollinated flowers to our friends. The answer is that the study of these phenomena has provided us with the most important clues we have to date for explaining the behavior of non-pollinated flowers! We now know that, in the deterioration of non-pollinated flowers, certain plant hormones such as ethylene, auxins and abscissic acid are involved, and these are the selfsame hormones that play such a crucial role after pollination! In fact, Fitting, in 1909 and 1910, was the first to use the word *hormone* (from a Greek word for messenger) in connection with plants. He discovered that the post-pollination phenomena in orchids can be brought about not just by pollination itself, but also by dead pollinia and pollen extracts. This led him to the conclusion that the triggering principle is chemical in nature, and to the forward-looking suggestion that it is a plant hormone, "Pollenhormon". We now know that orchid pollinia are a very rich source of indole-acetic acid, the natural plant growth hormone which is almost certainly identical with Went's "auxin". Let us now follow in some detail the events following close upon the heels of pollination, in a number of different flowers.

In terms of quick growth, pollen tubes threading their way through a style towards the ovules (the prospective seeds) can put in a truly amazing performance. In corn (*Zea mays*), e.g., with its very long "silks" (the stigma of the pistils), the distance covered, in not much more than a day, may amount to about a foot. (To visualize what this means, one could think of a medium-sized pumpkin which would give rise to a fire hose covering the length of a football field in that period of time!) Fast-growing though certain pollen tubes may be, it seems certain that they can send signals ahead. As soon as the pollen tubes emerging from the pollen grains have pierced the surface of the stigma, a wave of very specific information travels through the tissue of the style to other flower-parts. As early as six hours after the pollination of a *Petunia* flower, changes already begin to occur in the "machinery" for protein synthesis in the cells of the ovary (the lower part of the pistil, destined to change into a fruit). Within eight hours after the pollination of foxglove flowers (*Digitails),* the tissue at the base of the corolla-tube gets the message that the corolla can now drop off, and—following orders, so to speak—it will indeed begin to weaken. Biologically, this makes sense. The corolla is no longer "needed" to attract pollinators, and retaining it would consume a great deal of energy which could better be spent on the developing seeds (the fertilized ovules). Wilting of the corolla of *Petunia* is also initiated within a few

In the orchid *Cymbidium* cv. 'Camelot', a pollinated flower (right) begins to wilt soon after pollination, while the unpollinated flower (left) remains fresh-looking.
Photos: Tom Boyden

Flowers of the horsechestnut are marked with yellow in the unpollinated nectar-producing stage (right). The spots change to red after pollination (left), and nectar is no longer produced. Drawing: B.J.D. Meeuse

hours after fertilization. The speed at which the information travels through the style is of the order of one centimeter per hour; much slower than the pony-express, for sure, but still quite respectable for such a small thing as a flower! With the aid of the electron microscope, the Italian investigator Cresti has investigated the fine structure of the stylar cells through which the pollen tubes travel. The long axis of these slender cells runs parallel to that of the style, and it turns out that the cross-walls that separate them are pierced by an unusually large number of protoplasmic strands, so-called *plasmodesmata*. That these play a crucial role in the quick transfer of information from cell to cell is quite likely.

The findings described above have put us in a position where we can describe with some accuracy the natural senescence-event taking place in flowers after pollination. Germinating pollen grains in the stigma excrete plant hormones, especially auxins. After fertilization, the ovules, now turned into growing seeds, also have a high level of auxin. This hormone prevents abscission, that is, dropping off of the young fruit that is now forming, but also induces the pistil to form ethylene, a gas that diffuses through the flower and causes the petals to wilt. It should be kept in mind, however, that even in non-pollinated flowers (cut flowers in vases!), there will—ultimately—be a production of ethylene also. In this case, appearance of the gas is probably something indicative of senescence, rather than something which causes or induces that phenomenon, e.g., it has been shown that in the lower parts of the petals of carnations there is a production of ethylene which is independent of that in the pistil. Be that as it may, once ethylene has appeared on the scene it promotes further senescence. Commercially, a great deal of attention has therefore been given to *the prevention of ethylene-formation* in cut flowers, and to *elimination* of the gas as soon as it has been formed. Carnation flowers have now become an almost classical material for studies on these topics. In the later stages of their development, external administration of ethylene always leads to a shrinking of the petals. During its development, a carnation flower produces only small amounts of ethylene; just before natural shrinking occurs, however, there is a sudden rise in ethylene production, and there can be little doubt that this is responsible for the shrinking phenomenon. Recently, it has been found that silver salts exert an anti-ethylene effect in several cases where ethylene plays a regulatory role in the development of plants or plant organs. The reason may well be that in the natural course of events ethylene reacts with some copper-containing enzyme, which then triggers further reactions. Silver salts compete with the enzymatic copper for the ethylene, tying up the gas and thus making further reactions impossible. At this moment, the chances for practical application of silver salts, especially a silver-thiosulfate complex, look very good. Other compounds which retard flower senescence interfere with the biosynthesis of ethylene. It is practically certain that the natural precursor of that gas is methionine, a common amino-acid. The addition of certain chemicals can strongly inhibit a crucial step in the reaction sequence leading from methionine to ethylene. Among the effective compounds are the so-called free radical *scavengers*, a group which includes such compounds as sodium-benzoate, sodium iso-ascorbate, and alpha-tocopherol (vitamin E). Free radicals are compounds which, chemically speaking, are extremely active because they possess an unpaired electron. They have definitely been implicated in the methionine-to-ethylene conversion, and it is immediately clear that their elimination depresses ethylene production. This is the reason why sodium benzoate, added to the water in a vase with cut flowers, prolongs the latters' life-span considerably. Apart from this special role of the free-radical

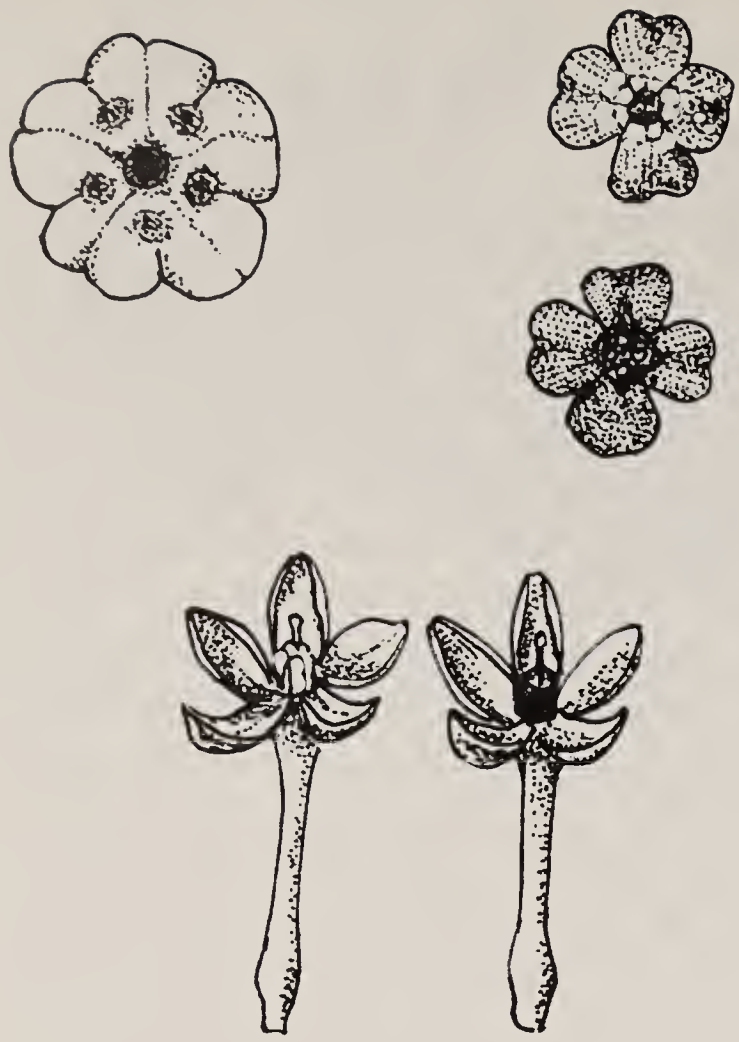
scavengers, they also exert a more general and equally beneficial effect, namely maintenance of membrane integrity. Living cells strongly depend on such integrity in order to function optimally. The extremely active free radicals can bring about the oxidation of fatty substances present in the cells' membranes, so that these are no longer functional. So, elimination of free radicals keeps a cell healthier longer!

ENJOYING THE INEVITABLE— POST-POLLINATION COLOR CHANGES

It is a truism to say that in human affairs the process of growing old should be accepted with grace. It can be a wonderful experience in that we learn a great deal by watching ourselves as we go through it. Likewise, it can be rewarding to see flowers age: they sometimes have great stories to tell! Very definitely, some species indulge in sign language, giving potential pollinators valuable information. The changes in color, pattern and odor through which they go represent such a language, whether they result directly from pollination or not. Horse chestnut flowers are among the most charming examples. Of the 4 or 5 petals which they possess, the upper two—which are larger than the others—each display a conspicuous nectar-guide, yellow in young flowers and red to crimson in older ones. The life-span of a flower is four days; the first of these is characterized by the yellow color and the last two by crimson, with an orange to vermilion transition-stage in between. Nectar is secreted only in the yellow stage and is normally no longer present in flowers with crimson nectar-guides. Both Kugler and Vogel have demonstrated that inexperienced, "naive" bumblebees visit both types with equal frequency. However, with the aid of their excellent color-discrimination they very quickly learn to avoid the nectarless, crimson-marked flowers, to occupy themselves only with the yellow-marked "rewarding" ones. This behavior constitutes a most elegant economy-mechanism which works to the advantage of both the insect and the plant: the bumblebees will not waste time on worthless flowers, while on the other hand only those flowers will be visited which are still in need of being pollinated. It is true that in this case the color change is simply a matter of time and has nothing to do with the act of pollination itself; the nectar-guides will turn red even in the absence of insects. Statistically speaking, however, it is very likely that under natural conditions a flower with a crimson honeyguide (that is, a flower which is three to four days old) has already been pollinated and "should" therefore be avoided. A legitimate question to ask is whether the flower could not achieve its end by simply dropping its "expensive" corolla when it grows old and the nectar-flow ceases; is not that what we see in many other flowers? The answer to this is that the crimson-marked flowers, although they have already fulfilled their biological purpose, may still contribute to the attractiveness—to insects—of the whole inflorescence with its many still unpollinated flowers. That the behavior of the bumblebees is determined by optical signals and not by differences in smell can be shown by offering the animals an inflorescence behind a colorless glass plate; they will discriminate between the two types of horse chestnut flowers even then!

Just as interesting as horse chestnut is golden currant (*Ribes aureum*), common as a wild plant in eastern Washington (and many other parts of the United States) and frequently grown as an ornamental in Europe. In this species, it is the golden-yellow calyx, 15 to 20 millimeters long, which forms the attractive part of the flower. The five rectangular petals, each not much longer than a millimeter, are arranged in a circle around the flower's entrance in such a way that they form an extension of the calyx-tube. In a young flower, the petals are yellow and remain so for three days; after this, they gradually turn red over a period of one to two days, to end up crimson. This last color-phase also lasts for one to two days.

In Europe, Vogel found the wild bee *Anthophora pilipes* to be the main pollinator. Individuals of this species behaved very much like bumblebees did on horse chestnut; they too learned very quickly to favor the young flowers, which were uniformly yellow, and to avoid the older ones with their crimson petals. As in horse chestnut, the color-change is independent of the act of pollination itself. (In other



Post-pollination color changes: in *Arnebia echioides* (upper left), the rusty-red honeyguides of the light-colored flower fade and disappear; in the purple *Aubrietia deltoidea* (upper right), the yellow nectar guides turn red; in *Ribes aureum* (center), the tiny golden petals near the pistil turn red.
Drawings: B.J.D. Meeuse, after S. Vogel

flower-species, however, for instance in certain lupines, the color change is strictly dependent on it.)

In *Arnebia echioides*, a plant in the forget-me-not family, the flowers are open over a five to six day period. The five conspicuous, brown-red nectar-guide spots on the petals, however, fade and disappear in the course of the first day, whether pollination has taken place or not.

It is not difficult to find many other examples of color-changes in flowers. Sometimes the whole corolla is involved. In the forget-me-not family, e.g., we find several cases where it changes from red to blue (*Pulmonaria* or lungwort). In the yellow-flowered races of *Lantana camara*, yellow sage, the whole flower changes from yellow through light-red to red—which leads to interesting two-colored inflorescences. The study of such phenomena is a delight. We recommend it!

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New Members of the Arboretum Foundation

We are pleased to welcome the following new members (September 1, 1981 through December 31, 1981: *Sponsor*—Lewis H. Johnson. *Sustaining*—Sally Lou Fuller, Mrs. Thomas MacLachlan, Mrs. John Neff. *Family*—Mr. & Mrs. Wm. Brown, Mr. & Mrs. John Fox, Mr. & Mrs. Lonnie Rodenberg, Melinda Smith, Mr. & Mrs. Brian Suher. *Annual*—Bettina Acosta, J. Michael Asbill, Mrs. Russell Ashleman, Mrs. Rosalie Auer, David beaudette, Glenna Beierle, Warren Berg, Richard Berner, Brenda Boardman, Marie Borgatta, Jan Burton, Norma W. Carder, Stanton Christie, Mrs. Melissa Clausen, Susan Cook, Leo Cunningham, Carol Dahlstrom, Betty K. Dorland, Mrs. Margaret Eilertsen, James P. Ferrell, Lynn Garvey, Alan Granger, David Hackman, Felicia Hantman, Mrs. Dorothy Hayden, Ruth Head, Elizabeth Herrick, Kristine Hilsinger Mrs. Gordon Huliner, Mrs. Pat Jefferson, Bonnie L. Johnson, Terry Ketcham, Alice Kimsey, Frances Kinsel, Elaine Krom, Maere Lambert, M. Sharon Leopold, Sybil Macapia, Mrs. Patricia McGuinness, Robert Michelson, Michael Munro, Mrs. Kimberly Peterson, Jane Powers, Patricia Pruss, Mrs. Thelma Ragsdale, Ruth Robertson, Mrs. Katherine Ryder, Jackie Saarela, Carolyn Schwager, Helen C. Staehli, Dawn E. Stanley, Mrs. Marjorie Sterling, Mrs. Maureen Swanson, David Thaler, Mrs. Gale Thompson, Lorraine Truitt, Douglas Tullar, Mrs. V.M. Walker, Laura A. Watts, Mrs. Rosemary Weimer, Mary Wellnitz, West Bremerton Garden Club.

A Rare Maple in the Arboretum, *Acer tegmentosum*

BRIAN O. MULLIGAN

This is the most attractive of the striped-bark maples so far as stem color is concerned. The green bark of the trunk is conspicuously striped with white wax, running all the way up the branches to the top. The young shoots are also coated with the same white wax. A most attractive specimen of *Acer tegmentosum* is located on the west side of Arboretum Drive, north of Rhododendron Glen. It is now 30 feet tall, after fifteen years in this site, where the soil is quite sandy and well drained. The trunk of this beautiful tree divides at five feet above the ground, then each main branch divides again higher up (see cover photo), to form a broadly vase-shaped head with the uppermost branches spreading outward. This form is characteristic of Asiatic maples of section *Macrantha*. *Acer tegmentosum* itself is native to Manchuria, eastern Siberia and North Korea.

The winter buds of this species are long and conspicuous, stalked, and covered by two dull red scales. The leaves are broad, almost as wide as long (9 to 11 cm), the apex acute, the base rounded, and the margin very finely serrate. There are two small acute lobes in the upper third of the leaf and often a smaller pair towards the base. The leaves are glabrous on the underside and there are three main veins arising from the base and raised beneath. The petiole is 4 to 5 cm long. The winged seeds (samaras), produced on the female tree by hand pollination, are each about 2.5 cm long, borne on very slender pedicels, the wings of each pair spreading widely to an angle of about 160°.[1]

Amongst native American maples *Acer tegmentosum* most resembles and is most nearly related to the moosewood, *Acer pensylvanicum*, of the eastern United States and southeastern Canada. Similarities include the pronounced striping of the bark, as well as fruit and foliage characters. The leaves of both turn pale yellow before falling.

Plantings in the Arboretum

Acer tegmentosum first came to the Arboretum in April 1938 in the form of two plants from the USDA Bureau of Plant Industry, Glenn Dale, Maryland. The seeds of the *A. tegmentosum* had been obtained from an Agricultural Experiment Station in Manchuria. According to the record in the file one plant was set out in the Arboretum in February 1946 but was later returned to the nursery for an unspecified reason. This tree is still there, now 27 feet in height with a trunk diameter of six inches. It is a female specimen, and from late March to mid-April, according to the vagaries of the season, produces slender pendulous racemes of small greenish-yellow flowers. Occasionally these flowers have been hand-pollinated with pollen from a male tree of the same species or of a related species. Fertile seeds have generally resulted from such work.

Two young plants of *Acer tegmentosum*, propagated by grafting from the tree in the nursery, were placed on the bank above Azalea Way south of Loderi Valley in March 1977. The larger west tree has now attained 20 feet but the smaller was severely damaged by having a large branch torn off in 1980, and is only half that size.

Scions from another tree of *Acer tegmentosum* were received from the Arnold Arboretum of Boston, Massachusetts, in February 1949. Two plants resulted from this material, of which one was planted in March 1952 on the west side of the parking lot between the Japanese garden and the Madison Street playfield. In Janaury 1958 it was noted as dead on the record card. In April 1953 the second plant

[1]See *UW Arboretum Bulletin* 35(3):4, Fall 1972, for an illustration of foliage and fruiting racemes.

went to the new area set aside for Asiatic maples, on the hillside west of the magnolias overlooking Azalea Way. Here it has thrived, and is now a small sturdy vase-shaped, multi-stemmed tree 33 feet in height. It has two main trunks, each of which divides again a short distance above the ground. This happens to be a male tree, and like the female tree produces its slender racemes of flowers in March or April just as the young leaves are developing. (This tree was illustrated, four years after planting, on the cover of the Fall 1957 *Bulletin*.)

Further propagations were made by grafting from this tree and two more saplings were planted on the west side of Arboretum Drive East, north of Rhododendron Glen, in February 1966 and March 1969. The first is the attractive specimen already described. The second tree, in a more open situation among the peonies, has not fared so well. A year or two after planting, the trunk was badly burned by sun on the south side. This killed much of the bark there and consequently greatly reduced its growth, forcing it to the north side. The tree is now only 21 feet tall.

Horticultural Attributes

Acer tegmentosum grows in the Shreder Botanic Garden in Moscow, USSR, so it can be expected to be hardy in all but the extreme northern tier of states in this country. Rehder's *Manual* (1940) places it in Zone IV, along with the black locust and scarlet oak; this is equivalent to Zone 5 of the USDA map (1956), with average minimum temperatures of -10° to -20° F. Plants hardy in this zone include *Rosa multiflora* and *Cornus florida*.

The catalogue of the Morton Arboretum, at Lisle, Illinois, recorded two plants of *Acer tegmentosum* there in 1971. In 1958 *A. tegmentosum* was growing at Rochester, New York, at the Montreal Botanic Garden, and at the Finch Arboretum, Spokane, Washington. By now there may be more plants established in other arboreta or botanical gardens, but I know of no commercial source for this tree.

Because of its striking winter effect, the handsome foliage and considerable hardiness, this is certainly a maple which should be propagated, preferably by seeds and on a large scale for adequate testing over a wide area in this country. It would add new stem color to our gardens in the winter months.

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Forestry Education Enters Seventy-fifth Year

Seventy-five years of forestry education at the University of Washington will be commemorated in various ways during the 1982-83 academic year. The first event will be the dedication of the new Pack Forest classroom at the ceremony beginning at 10:00 AM, Saturday, July 17. The formal dedication will be followed by a barbecue picnic for faculty, staff, students and guests. The event will be open to the public, but the College would appreciate notification of intent to attend.

Festivities will shift to the Seattle area for a series of events starting Thursday, October 7, with Alumni Tours to nearby areas where UW alums have effected significant changes in forestry practices. Tours to the Cedar River Watershed, Pilchuck Tree Farm, and Pack Forest are being arranged.

Friday, October 8, will be a day of seminars, open house at the College, and hospitality, culminating in the 75th Anniversary Alumni Banquet in the evening. On Saturday, a block of tickets has been held for the UW-California football game in Husky Stadium.

For further details write 75th Anniversary, College of Forest Resources AR-10, University of Washington, Seattle, Washington 98195.

Jeanne and Arthur Gardiner against the dazzling backdrop of Mount Minya Konka.

The Other Side of the Mountain

A Plant Explorer in Tibet

Part I—China

*JEANNE GARDINER**

The notice in the travel brochure was only three lines. "Permission has just been granted by the Chinese government to allow trekkers to visit an area on the Chinese-Tibetan border in the vicinity of Mount Minya Konka, one of the most remote corners of the earth." This had been the site of many of Ernest Henry (Chinese) Wilson's plant-collecting expeditions in the early 1900's. While I had devoured every book on plant exploring in the far reaches of China, never did I dream that in my lifetime China would open to foreigners, and that I might become part of the picture.

My husband Art, and I had planted hundreds of rhododendrons and azaleas in our two-acre garden. I have always been drawn to the species of *Rhododendron*, especially to those of China. When each new rhododendron was planted I would imagine the mountains where its great-great-grandparents might have been "born." In addition, I had been presenting programs about the early plant explorers to various gardening groups. Suddenly these developed a new dimension—skyrockets exploded! Perhaps I could become a plant explorer too . . .

Minya Konka (or Gongga Shan, as the Tibetans know it) had been climbed in 1932 by four daring young Americans. Now, for the first time in fifty years, a climbing expedition had been given permission to attempt to climb the mountain, with the trek by non-climbers into the same area as an added bonus.

* Jeanne Gardiner has been active in the Arboretum Foundation for 18 years, and is particularly known as the "Bulb Lady." She credits her love of plants to her mother, Myrtle De Friel. Since 1963, she has enjoyed many trips to the Orient with her husband Art.

History

Because of the difficult high terrain, Tibet has always been an isolated kingdom, remote from the world. When China took control of Tibet in the 1950's, the isolation increased. The Dalai Lama, Tibet's spiritual leader, and thousands of his followers retreated to Nepal, India and Sikkim. On our trek through the Tibetan Autonomous Prefecture which has been administered by China since 1965, we saw those who had stayed behind. We viewed the old, continuous life of the Tibetan—the herders, farmers and close-knit, self-sufficient villages which have existed back beyond history.

Today, China has cracked the door, and travel opportunities to tour even Lhasa to see the Potala, that sprawling, many-storied, mountain-top palace of the Dalai Lama, have become a reality.

In 1977 we had joined an English trek which circled from Darjeeling, up to 12,000 feet at Sandakphu and back through Nepal in springtime, when all the primulas and rhododendrons were in full flower. The next year in the fall we had spent several weeks in a remote area of Sikkim, trekking as far as Thanzing meadows at 14,000 feet. We gathered quantities of fresh rhododendron seed in the mountains covered with forests of large rhododendrons, and walked miles on high plateaus collecting seed from foot-high plants above the tree line. Now, in the fall of 1980 we signed up to visit "The Other Side of the Mountain." We would fly west instead of east, and meet the rest of our group of twelve in Tokyo.

Despite our romantic ideas, we knew this trek would entail much hard work and that we might be the only plant-oriented people in the group, since most were hikers going to do some climbing. First we would need to get into shape. Every time I looked out our windows at Mount Rainier I gulped, for we would be climbing higher than its 14,408 feet. This trek would require months of conditioning as often in the local mountains as time permitted, the rest on the Tolt River trails near our home. We needed thorough doctor's exams to acquire certificates for climbing over 15,000 feet. We had lists of special equipment: clothing for cold weather and rain, warm sleeping bags and pads, well-fitting boots, and all to total less than 30 pounds! What a logistics problem. Weeks of preparation went into outfitting ourselves.

Classical roof figures grace Two Prince Temple at the Sichuan Irrigation Project in Chengdu (page 21).
Photo: A. Gardiner

Appropriate Literature

The travel company provided a good book list which afforded us many hours of pleasure. Old copies of *National Geographic* covered Joseph Rock's expeditions into this region. We read Teddy Roosevelt's *Trailing the Giant Panda* where he had marked on a map a mountain perhaps 30,000 feet high, then added a question mark, "Perhaps this is the highest mountain in the world." His book had been the inspiration for those four young Americans in 1932 to determine whether Minya Konka was indeed the highest mountain in the world. (At 24,950 feet, it is not the highest in the world, but one of the most beautiful.) We envisioned landslides and chasms while we read Tayman's *Stillwell Road—Land Route to China*, written during World War II. We learned that in the 1920's there was not a single wheeled vehicle except wheelbarrows in all of the region around Chengdu, the capital of Sichuan Province. A missionary introduced a motorcycle and the "good roads" movement began there. Wilson's books on plant exploration all give vivid pictures of the high country and of the hardships of making a trip to a completely unknown land. I was able to make lists and descriptions of some of the plants we expected to see on our trek. I read *China, Mother of Gardens* and later bought the two volume reprint of *Naturalist in Western China* from which the first book was drawn. The best book for the area we would cover is the two volume *Aristocrats of the Garden*.

We pored over each letter or pamphlet from

the travel company. Maps are almost non-existent for this part of Asia and there were many instances where we could find no town names for where we were heading. In addition, many of the Chinese names have been modernized, the old names have several spellings, and many places have both Tibetan and Chinese names.

Mandarin has been selected by the Chinese government as the official dialect of China; Pin Yin is the accepted modern system for spelling Chinese words. Thus Peking has become Beijing, and Szechwan is now Sichuan. The Chinese themselves have become used to "Peking" and know what a tourist means. But the Pin Yin system is helpful to the English-speaking traveler because the new spellings are as close to English phonetics as possible.

The Route

Our flight would take us from Beijing to Chengdu, where we would come under the leadership of the Chinese Mountaineering Association, a new organization formed to take care of mountain travelers. Our first day by jeep would entail crossing the plains to Yaan, the next would be to drive over a 15,000 foot pass to Kanding (more frequently known to travelers since Marco Polo's time as Tachienlu) and the third night we would stay in Liu Baxiang before setting out on foot. This last name really puzzled us; it appeared on no maps, though we could find the winding road to Lhasa upon which we would travel part way. Our leader advised us that Liu Baxiang was too small to be on any map; it was only a two-house village at the "end of nowhere."

Departure

My diary reads: "D-Day is October 18. We have emptied the dining room of all gear. It has been awash with things-we-might-need, and half must be left behind. Honing down to essentials, we each stuff a 30-inch duffel bag. Art's day pack carries three cameras and lenses and 40 rolls of film. My pack has a small cardboard plant press, seed envelopes, plastic and paper bags for specimens, notebooks and large brown envelopes." Amateurish? Yes, but on each trip we become a little more efficient.

Checking off each item, we fill the train case with the required medications, our personal

Sidewalk shoe-mending, Chengdu (page 20).
Photo: A. Gardiner

necessities, and one suitcase which will be left behind in Chengdu with "city clothes." Our boots will be slung over our shoulders and the camera bag is listed as an unweighed carry-on. Total weight—84½ pounds. When we arrive in Chengdu our gear for the trek must all fit into the duffel bags or our day packs—well, we will think about that later.

Louise Czerniski, a Seattle friend, joins us at the airport. We become apprehensive, envisioning primitive villages set on sheer cliffs, and swinging woven bamboo bridges slung over mountain torrents. Will soldiers need to accompany us to clear landslides and protect us from bandits? All the same, we take off for the unknown.

Chengdu and the Red Basin

Upon meeting our trekking companions in Tokyo we find that most are worldly-wise confident travelers, who have been on other mountain treks. From overnight in Tokyo we skim

through Beijing with the promise that there will be more time on our return. Chengdu, across the breadth of China, has a very different atmosphere. There is the same interest in foreigners there that we found in Beijing in 1979. We are stared at and giggled over and crowds press close to watch while we purchase a string bag or a few tangerines. Tiny stands are set up along every busy sidewalk: shoe mending, pot soldering, the sale of second hand garments.

In Chengdu we check into the Jin Jiang Hotel. Jin Jiang means "brocade". The river flowing by outside has the same name. For centuries Chengdu brocade, washed in the "Brocade" River, has been famous for its lustrous colors. We wonder if this river is still the bathtub for the beautiful product we purchase to bring home.

Today we leave in 12-passenger buses. We will be able to sit higher and see so much better than if we were in jeeps and we avoid much of the dust. Our gear goes on a three-ton stake-bodied truck, well-covered and tied down. Our two buses are filled to capacity with overnight necessities, all of us, and the Chinese staff. Jaio, the Commissary officer, repeats tapes of country western and Chinese music until we all vow to send him new tapes when we reach home.

Chengdu is a city of over a million and the suburbs continue through miles of small villages, one melding into the next. This main road is perhaps 20 feet wide, jammed with all kinds of vehicles, constantly honking. Peasants plod, bent under heavy burdens, bicycles tow loaded carts of kale, chard or cabbage, wagons are filled with the night soil enroute to storage tanks beside fallow fields. Horses pull creaking carts of bricks, coal or vegetables.

The fields of purple-brown clay soil stretch flat as far as the eye can see. It is autumn now and the rough clods in the resting land have all been turned by hand. Lines of workers, perhaps 20 to 50 long, labor over new areas that have not yet been finished. Many farmers chop with their hoes in unison and occasionally we hear a group singing.

Every inch of tillable land is in use. Sugar cane, broad beans and rape seeds are the main crops. Cabbages line ditches, other leafy vegetables fill little patches in three-by-five foot open spaces. Something is planted under every tree. These are the personal plots which the government allows the workers, so that they can eat or sell extra produce.

Lumber is handcut with a long rip-saw operated by two people. Either a tree is sawn horizontally from one end to the other or one person works above, with another below in a pit. Houses here in the Red Basin have thatched roofs, but most buildings are made of bricks. Brick kilns are common all along the road;

Jeanne Gardiner bargaining for tangerines near Chengdu—a crowd-drawing attraction. **Photo: A. Gardiner**

piles of finished bricks are laid up with straw between the layers. We also see coking coal briquets being pressed and formed. Perhaps this is the coal used to bake the bricks. There are many lime kilns too.

In every ditch or scratching in the mud are chickens, goats, cows, pigs, ducks, geese—but only rarely a dog, for dogs eat food that people might need.

There seems to be plenty of water. This is the famous Red Basin, irrigated for 2200 years by an intricate system of dams and canals. This system allows for the richest harvest in all China and controls the amount of water released, preventing the almost yearly floods which devastate the Yangtse and Yellow River basins. At a museum and beautiful ageless temple we are told the story of the engineer governor, Li Ping, and his son, who laid out this engineering marvel. Recently the system has been expanded through the mountains by tunnels to reach rich lands on the other side, yet Li Ping's formula is still valid today, "Dig the river deep, keep the banks low." The river is the Min, a main tributary of the Yangtse. All canals have been dug by hand. In the misty far distance we can see the Panda Preserve where the special bamboo to feed them grows. Someday all this will be part of the tourist circuit.

Straw stubble lies where the clods in the fields have been turned, bales of hay are piled in corners and stacked in teepees, grain already threshed is spread out on wide concrete slabs to dry and children or old women are turning it. Clusters of newly tied brooms hang from a roof while laced along a line are skeins of white cotton. They resemble pasta drying. There seems to be no lack of water power—we drive along one rushing river after another. First we follow the Ching Lai, then the Min Ja and as evening deepens we cross the bridge over the Ya into Yaan. On the hillsides above are tea bushes, though less well-groomed than those on the steep hillsides below Darjeeling.

Food provided by our Chinese Mountaineering Association hosts has been outstanding. There were banquets in Beijing and Chengdu and now each night we are introduced to new tastes and new guessing games. Fish from freshwater ponds, vegetables we can't quite identify, spicy sauces with lots of hot peppers,

Vegetable harvest at a commune in China (page 20).
Photo: A. Gardiner

lichi rolled in a sweetened crunch, dumplings plain or meat-filled, peanuts and chicken, and best of all—duck barbequed in camphor leaves with smoke sauce!

Into the Mountains—Er Lung Pass

After we leave Yaan mountains appear before us, then beside us. Rice terraces march up every tillable space on the high cliffs. Now we become aware of some of the problems of transportation. There are rock and mud slides and even places where the road has disappeared. Many a spot we cross over with one wheel in thin air and hearts in our mouths. Each road section is repaired by the local inhabitants. The governor of the province attaches a levy for road building and advises the local district to supply the labor. Women and men work together pounding big rocks into little rocks, shoveling mud off the road or building protective rock walls. From time to time hundreds of workers gather river rocks which they carry in baskets on their heads or shoulders up to the road builders above.

We pass farm hamlets. There are huge ears of corn braided into four-foot sheaves hanging from the roofs. These indicate plenty for

Cutting lumber with hand-powered ripsaw (page 20).
Photo: A. Gardiner

Clockwise from upper left: Overlooki
main tributary of the Yangtse, with the
21). *Clematis* adorned with snow, ne
braided into a sheaf—and the woven
catties (bricks of a certain weight) is c
(page 24). *Iris* found on a Sichuan hil

ne irrigation project on the Min River, a
da preserve in the misty distance (page
iu Baxiang. A symbol of plenty—corn
s of Yaan (page 21). A heavy load of tea
d across the iron chain bridge of Luding
at 3500 feet (page 24).

Photos: A. Gardiner

that household for the winter. The villagers eat from full rice bowls—there is no starvation here.

The people look different from those in Beijing, more girls wear braids and their faces are flatter and broader. Are we approaching Tibetan country?

Vestiges of forests which must have covered all these hills include a few spindly, needled trees. There are charcoal pits with smoke rising; could this be the reason for the lack of trees? The land is overworked, the peasants are overworked, but it is an industrious proud poverty. No one seems hungry, and everyone has enough clothes even though they may be patched. Consider the problems of feeding almost a billion people! We honk and move on, missing by an eyelash, livestock and men and women carrying heavy loads.

While we follow the river bottom the land is mucky clay. A pottery works is molding large reddish clay vessels. We see corn shocks on every hillside—corn above and rice below. Corn may have originated in Mexico but it has become a staple in this part of China. Tsen, our interpreter, tells us that this area has two crops of rice a year or one crop of rice and one of winter wheat if it is too dry for the second crop of rice. I have not mentioned flowers, for with so many mouths to feed, food must come before flowers. But ahead are some ferns hanging from an unreachable cliff and over there is a purple aster.

Er Lung Pass is ahead. The road snakes up and up fantastically. We must stop to let trucks pass. I am glad they are on the outside for there is barely room for one vehicle with the void below and mud slides above waiting to descend. They squeeze past, each driver moving only inches at a time. Below are the chasms that Wilson so graphically described. These are the fog-shrouded hills of painted screens.

Mountain Plants

The mountains are limestone. Over there is a large patch of flowering bamboo. Will it die and be reborn as new seedlings? The climate is semi-tropical, even at an elevation of 3000 to 4000 feet. We see cannas, papaya and banana trees, and a long flower something like red cassia. Tsen, our guide and interpreter, tells me it is dried and crushed and added to bread flour for flavor. At 3300 feet, we find *Cryptomeria* growing.

While the bus waits for road repair we get out and walk. Above me on one side of the hill is something which resembles iris fans! We take pictures and dig for specimens with sticks and with our fingers. This is an iris with a wide fan, and a rather floppy stem 8 to 10 inches long, different from any iris I recognize. I wrap a couple of pieces in mud and store them in a plastic bag. They will stay in that bag for a month and still be alive when we reach home. Though the iris may be too tropical to grow outside in Seattle, Jean Witt, our iris fancier, will be glad to see it.

Now we climb more rapidly. Snow pockets on black Er Lung mountain are only 600 feet above us, autumn has come to the mountains. The forest trees are large here and the maples have turned red. One tree may be a red-leaved dogwood, and three-foot rhododendrons, our first, are scattered over the windswept hills. The altitude is almost 10,000 feet at the top of the snow-covered pass.

The Chain Bridge of Luding

Toward noon we arrive at the famous iron chain bridge in Luding. For over two hundred years each traveler, plant explorer and historian who has seen the bridge has described it. It is the same today as in the 1700's, made of hand-forged links, each eight inches long, joined into 13 chains which span a raging mountain river, the Dadu, 100 feet below. The bridge floor is fashioned of wooden boards loosely laid over the chains. Two of the chains form railings on each side to serve as protection from falling overboard, one about six inches above the floor, the other about three feet above. The other nine chains support the flimsy boards. Art, a bridge engineer, is appalled at the tiny round pieces of wood tucked into the teeth on the gear wheels which circle the big drum set at one end of the bridge to tighten the chains. One slip . . .

History tells us that Emperor Chin Kang Yi set 12,000 households to making the iron chains for the bridge. It is 103 meters long (over 300 feet) and three meters wide. Constant foot traffic crosses, carrying heavy loads of logs or tea; the bridge sways and bounces.

Close, now, to Tibet: villagers who have been moving rocks in the fields of Liu Baxiang. **Photo: A. Gardiner**

The bridge figures in recent history. Mao Zedong (Mao Tse-tung) and his Red Army won an important victory at the bridgehead, defeating Chiang Kai-shek.

For lunch we eat our first "1000 year" eggs. They are actually uncooked duck eggs wrapped in clay and lime, placed in a jar and sealed. Left for at least 15 days, they are then ready to eat, with dark yolks and jellied brown whites. They are offered as a gourmet treat and those unwilling to taste miss a part of Chinese culture. We always have peanuts for meals; today they are pickled. There are also sweet dumpling rolls. Food is different from Beijing meals—sauces are hotter and unfamiliar vegetables are introduced. Little candied "apples", eight or ten impaled on a stick, are dessert. Tsen says they are not apples and the seeds *are* different, but they look and taste like small crab apples. Delicious yellow Chinese apples travel with us on the bus for snacks.

Tomorrow . . . Tibet

The highway has deteriorated, the pavement ended somewhere way back, and the road is full of rocks and landslides. We have seen surprisingly few accidents, but oh! the near misses. Today we will drive over the border from Sichuan Province into the Tibetan Autonomous Prefecture.

The Loss of *Davidsonia*

It is most regrettable that the valuable quarterly journal *DAVIDSONIA*, which has been published since 1970 by the Botanical Garden of the University of British Columbia, Vancouver, B.C., is being terminated with the Winter issue, 1981, owing to major cuts by the University in the 1982-83 budget.

Since its inception *DAVIDSONIA* has, under the supervision of Dr. Roy L. Taylor, Director of the Garden, maintained a steady flow of highly informative, well-illustrated articles, dealing principally with the native woody and herbaceous plants of the Province, and with the continuing progress and development of the Garden. An Endowment Fund is being set up to support programs and publications in the Garden, so it is much to be hoped that this excellent journal will again be continued, and will become available in the not too distant future.

B.O.M.

News from the Center for Urban Horticulture

At the December, 1981 meeting, the Board of Directors of the Arboretum Foundation voted $40,158 to support four special projects of the Center for Urban Horticulture pertaining to the Arboretum. The first project is renovation of the camellia collection in the Arboretum. The present collection will be reviewed, overgrown plantings pruned and thinned, new specimens from the nursery introduced and duplicates discarded. Labels will be replaced and made more accessible. This is the first in a long series of planned renovations for the Arboretum collections which, in many cases, are in need of thorough overhaul to be useful for both educational and display purposes.

The causes and control of *Cornus nuttallii* leaf anthracnose, the epidemic disease of northwestern dogwoods, is the subject of graduate student investigations in plant pathology. The disease organism causes damage to the foliage, but also invades the stem where perhaps it can remain undetected for some time. Attempts are being made to culture the organism on artificial media as an essential step toward classification.

Development of a master plan for educational activities in the Arboretum is the subject of a Master's degree thesis. This study will analyze the resources available to the Center including staff, volunteers, funds and facilities, and the audiences to be reached. The next step will match resources with educational activities of interest to various horticultural audiences. Such a Master Plan will help in coordinating training of volunteers, and will set priorities for preparation of slide sets, brochures and other teaching materials by Center for Urban Horticulture staff. Materials produced for use in the Arboretum will be available for other programs.

Second only to pest management, weed control is the most costly operation in maintenance of many landscape plantings. Most of the scientific information about weed control comes from work in agriculture which often emphasizes use of chemicals. These results are not always applicable to mixed plantings in urban situations. With the cooperation of faculty of the Washington State University Experiment Station at Puyallup and the Center, a graduate student will investigate several methods of weed control, including use of mulches, ground covers, rotations, plant selection, and chemicals to develop practical methods of effective weed control in private and public gardens. Results from this work will be used in maintenance of the Arboretum and will be made available to others interested in landscape maintenance.

In other news, the barracks housing at Union Bay Circle has been cleared, 6000 cubic yards of fill soil trucked in, and the area is fenced in preparation for planting of research plots this spring and summer. Plans are being developed for planting the research arboretum for testing of promising horticultural plants.

The Center needs equipment to develop the Union Bay Research Area. If anyone has the following in good condition that they would care to donate or make available, please call Dr. H.B. Tukey, Jr., Center for Urban Horticulture, 543-8616:

Tractor similar to a John Deere 301, large enough to accommodate a front end loader, rototiller.

Equipment for tractor listed above, such as front end loader, rototiller, wagon, plow, disc, and grader blade.

Truck, 2-ton dump

H.B. TUKEY

A grove of native red alders *(Alnus rubra)* near the lagoon at the north end of the Arboretum (page 29).
Photo: B.O. Mulligan

Alders in the Arboretum

Part I—North American and European Species

BRIAN O. MULLIGAN

Introduction

Most alders (*Alnus* B. Ehrhart, 1753) are considered to have little ornamental value in a garden. Their flowers are generally inconspicuous, the leaves do not change color appreciably in autumn and the small cone-like fruits have a limited decorative value when dry, even if they remain on the branches. However, alders have valuable characters which make them useful in particular situations. As a whole, they are a hardy race of trees and shrubs. They grow rapidly, as much as four to five feet in a season in the case of our native red alder (*Alnus rubra)* and the Italian alder (*A. cordata).* Many species of alders tolerate and even enjoy wet soil conditions, growing naturally along river banks or in low-lying valley bottoms; these include *A. glutinosa* in Europe, *A. rubra, A. incana* subspecies *rugosa* and *A. tenuifolia* in the United States, and *A. japonica* in Japan. The quantities of yellow or bronze-colored catkins produced in early spring before the leaves develop make alders quite decorative at that season. The Italian alder and some of the smaller Japanese species such as *A. firma* and *A. sieboldiana* are particularly noteworthy for this attribute. Some species of alder are small shrubs, while others become large trees. This makes it possible to select types suitable for different situations and conditions in home gardens and in parks and arboreta.

In addition to their horticultural value, alders add organic nitrogen to the soil by means of nitrogen-fixing microorganisms (actinomycetes) contained in nodules formed on their roots. This fact has been well known for many years, and has lately been receiving more

attention in commercial forestry. In this respect alders are said to be more efficient and productive even than leguminous plants. Alders are also among the most successful types of trees for revegetating old mining dumps and other disturbed areas.

The genus *Alnus* is indeed of very ancient origin, the earliest fossil specimens dating back to the Upper Cretaceous period, more than one hundred million years ago, and becoming more frequent in the Tertiary period and succeeding epochs.

Alders have woody, persistent "cones." Thus they are separated from birches (*Betula*) which have pendent or sometimes upright fruiting spikes that disintegrate when ripe.

At the present time about 30 species of *Alnus* are recognized. Their range extends across all the continents in the northern hemisphere, in America south through Central America and down the Andes chain as far as northern Argentina where the subspecies of *A. acuminata* are found. In Asia alders occur throughout the Himalayas (*A. nitida* and *A. nepalensis*) to southern China (*A. trabeculosa*), with *A. japonica* in Korea, Japan and Taiwan. Japan boasts eleven species of alder, six of which are found nowhere else. This country is clearly one of the centers of distribution of the genus. In North America, including Mexico, there have been eleven species but several of these (*A. rugosa, A. tenuifolia, A. sinuata* and *A. crispa*) are now considered by the monographer of the American species of the genus, Dr. J.J. Furlow, to be only subspecies of others. This nomenclature we are now following in the Arboretum records and labels.

Most alders flower in early spring either before or during leaf development, excepting the three species with *solitary* "cones" (forming the subgenus *Clethropsis*) which flower in the autumn. These autumn-flowering species are *Alnus maritima* from Delaware, Maryland, and from one isolated stand in southern Oklahoma, *A. nitida* from the northwestern Himalayas, and *A. nepalensis* which extends from the Himalayas into western China. (None of these is represented in the Arboretum at the present time, although *A. maritima* certainly should be.)

The subgenus *Alnobetula* contains the three shrubby taxa, all adapted to mountain habitats, lakeshores, bogs and similar situations. *Alnus viridis* from central and southeastern Europe is the first described representative of this group. The distributional patterns of subspecies *crispa* and *sinuata* overlap from Alaska to northern California; hybrids may occur between them. Subspecies *sinuata* is the common scrub alder of the Cascades range, while subspecies *crispa* extends even into northeastern Asia.

In the subgenus *Alnus*, which includes most of the true tree types, the winter buds are distinctly stalked and the flowers are produced later in the growing season. This is in contrast to the members of subgenus *Alnobetula* and to the closely related Japanese species *A. firma, A. pendula* and *A. sieboldiana*.

Plantings in the Arboretum

In the Arboretum we have six species or subspecies of alder from North America. The red alder (*Alnus rubra*) is a common native tree especially in the wetter areas along river banks and around lakes. From Europe we have four and from Asia ten species. We also have seedling trees of a natural hybrid from Korea (*A.* x *mayrii*) and established trees of two garden- or nursery-raised hybrids of German origin, namely *A.* x *spectabilis* and *A.* x *spaethii*. Thus there are twenty-three taxa in the Arboretum collection, including the hybrids.

No longer growing in the Arboretum are *Alnus jorullensis* (*A. firmifolia*) from Jalisco in western Mexico, of which some specimens survived for more than five years; the Japanese *A. matsumurae*, killed after two years by the early freeze of November 1955; and the two shrubby North American subspecies (*A. crispa* and *A. sinuata*) of the European *A. viridis*. *Alnus crispa* survived for nearly twenty years on Foster's Island, and *A. sinuata*, which is native to the Cascade ranges of British Columbia, Washington and Oregon, lived for slightly longer on the bank of the lagoon just south of Foster's Island. Neither of these, however, is a particularly ornamental species, and typical *A. viridis* from two different origins can be seen in the collection. It seems probable that all of these alders would prefer conditions of both soil and climate different from those

they have to tolerate in Seattle.

Three different areas have been utilized for the alders. The first was on Foster's Island at the north end of the Arboretum adjoining Lake Washington. This was deemed to be a suitable site since our native red alder (*Alnus rubra*) grows there along its swampy margin. The soil is a moderately acid Bellingham silty clay, usually stratified in layers of clay below 18 inches depth which may cause poor drainage.[1] The first plantings were made here in November 1947. There were 38 plants under nine specific names, usually three of each kind. They included *A. glutinosa, A. incana, A. japonica* and *A. tenuifolia*, raised from seeds from various arboreta or botanical gardens. Plantings here were continued annually for four years, until November 1951. In December 1959, additional plantings included the hybrids *A.* x *spaethii* and *A.* x *spectabilis*, propagated from scions received from the Department of Parks, Rochester, New York, in February 1957. Later, in December 1965 and January 1966, six plants of the newly described Japanese species *A. inokumae* were placed in two distinct sites. Much more recently, in January 1981, plants of *A. subcordata* from Iranian seeds have been added to the area just east of the bridge leading on to the island. By 1959 some plants had either died or been destroyed by vandalism; more had perished by 1970 when another accounting was made. Few specimens now remain here. There is a 48-foot tree of *A. glutinosa* which originated from seeds received from the Royal Botanic Gardens, Kew, and there are two 32-foot individuals of the same species from the Morton Arboretum. Three healthy specimens of *A. japonica*, from seeds from the Royal Botanic Garden, Edinburgh, have flourished; the largest is 58 feet in height. The Italian alder, *A. cordata*, obtained from a nursery in Ohio and planted in March 1951, has attained 70 feet, being somewhat drawn up by adjacent trees of our native cottonwood, *Populus trichocarpa*. The foliage of the Italian alder, similar in shape and texture to that of the cultivated pear, is very different from the lanceolate foliage of the Japanese species, resembling that of the cultivated peach. The cones of both, however, are about an inch long, some of the largest in the genus.

Typical alder catkins and "cones", in this case of *Alnus hirsuta*. **Photo: B.O. Mulligan**

The second, and as it proved, the most succesful planting was in the area between the south end of Azalea Way and Lake Washington Boulevard to the west, opposite the pond at the foot of Rhododendron Glen. The soil here is a slightly acid Issaquah silt loam, the subsoil a clay loam or clayey sand, draining better than the Bellingham type and having the advantage of a small creek for this purpose at the lowest point of this shallow valley. A collection of some twelve kinds of shrubby dogwoods (*Cornus*) had been planted here in 1948 and 1949. Placement of the alders started in April 1953, with six plants of four kinds including the Japanese *A. firma*, then continued annually (except for 1957) until March 1962. During that time 46 plants—15 species and two hybrids—were set out here; they included some of American, European and Asiatic origin, mostly raised from seeds as with earlier plantings. No more than three plants of each kind were used, and since 1959 the height at planting has been noted in the records.

[1]See "Soils of the Arboretum", by Dr. S.P. Gessel, *UW Arboretum Bulletin* 29(3):69. Fall, 1966.

Foliage of the native red alder, *Alnus rubra*.
Photo: B.O. Mulligan

The third site lies to the north of East Foster's Island Road, just east of the intersection with Lake Washington Boulevard, north of the East Lynn Street footbridge. This is one of the principal sites in the Arboretum for native alders; some of these trees are more than 80 feet in height with a trunk diameter at breast height of 20 inches. The soil is the same Bellingham silt clay as on Foster's Island, but must drain better into the adjacent channel from the lake as well as into the creek which flows through the area. The chief problem in planting was locating sites where the alders would not be overshadowed or suppressed by the native trees. The first alders set out here, in December 1968, were three specimens of *Alnus inokumae*, a Japanese tree of which we had received seeds from its describer, Professor S. Murai of Japan, in February 1963. At planting these saplings were already 19 to 22 feet tall. The next group to be located here, in January 1972, was comprised of eleven plants of five kinds, ranging in height from 10 to 15 feet. Amongst them were *A. trabeculosa* from Japan and *A. serrulata* from Maryland. The third principal planting here was in November and December of 1974, duplicating some of the species planted in the second site but adding *Alnus jorullensis* from Mexico, *A. oblongifolia* from Arizona and a fresh stock of *A. pendula* from northern Japan. Finally, another large plant each of *A. serrulata* and *A. firma* were moved here from the nursery in December 1976.

The results of all these plantings have been mixed, with some species making much better growth than others. These differences perhaps are due to site variations in light and soil conditions. In addition, trees of larger sizes, when moved, take longer to recover and to grow satisfactorily than smaller individuals.

American Alders

Apart from our vigorous and prevalent native red alder, American alders are rather poorly represented in the Arboretum. Of *Alnus incana* subspecies *rugosa*, from the eastern United States, there exists only a single specimen. This tree was raised from seeds received from Swarthmore College, Pennsylvania, in 1966. It was planted out in December 1974 when 12 feet in height but has now achieved only 13½ feet. *Alnus incana* subspecies *tenuifolia* was raised from seed collected at Fort Saskatchewan, near Edmonton, Alberta, in 1955. Five plants were eventually placed in three different locations, but only two now remain as bushy small trees on the bank beside the lake channel facing the north entrance to the Arboretum. After almost twenty years, one is now 15 feet, the other 20 feet in height, with trunks five inches in diameter. Since this subspecies is found growing along stream banks in the hills in all the western states, including Washington, it should be relatively easy to obtain fresh seeds from several sources.

Another species which just reaches Washington from the south is *Alnus rhombifolia*, the white alder. This species is also represented by only a single tree, now 52 feet in height, growing in the main collection west of Azalea Way. This tree was propagated from seeds sent by the Arboretum of the University of California at Davis in March 1958 and was planted out in Janaury 1960 when seven feet tall. In 21 years it has grown 45 feet; the site is a wet one, even in summer, which probably helps to account for this growth rate. Plants from another seed lot, in 1957, from the US Forest Service at Berkeley, California, were

planted in 1959 on Foster's Island. They survived for about six years, while others in the *Cornus* section lived for ten. Fresh stocks and new plantings of this species would be desirable.

Alnus serrulata, the smooth alder, is native from Nova Scotia and Quebec south to northern Florida, and along the shores of the Gulf of Mexico as far as eastern Texas. An isolated colony also occurs on the sand dunes at the south end of Lake Michigan in Indiana. In the Arboretum three young plants can be found in area #3, close to the creek and Lake Washington Boulevard. These were raised from seeds collected in Calvert County, Maryland, adjoining Chesapeake Bay, in 1966. The plants were set out in January 1972 when 10 feet tall. One has now attained 15 feet but the other two are no larger than when planted and their foliage is yellowish. Evidently, either the soil or other site conditions do not suit them here and a fresh start is needed elsewhere.

In March of 1970, seeds of the Arizona or New Mexico alder (*Alnus oblongifolia*) were sent to the Arboretum from the Northern Arizona University at Flagstaff. One plant resulting from these was placed near the *Alnus serrulata* in December 1974 when 10 feet in height. By September 1981 it had attained 19 feet although the leading shoot was dead, indicating some problem at the roots or in the soil beneath. Because *Alnus oblongifolia* is found in a mountain habitat, it may be difficult to acclimate this species to Seattle conditions. A trial in another perhaps drier site would be worthwhile.

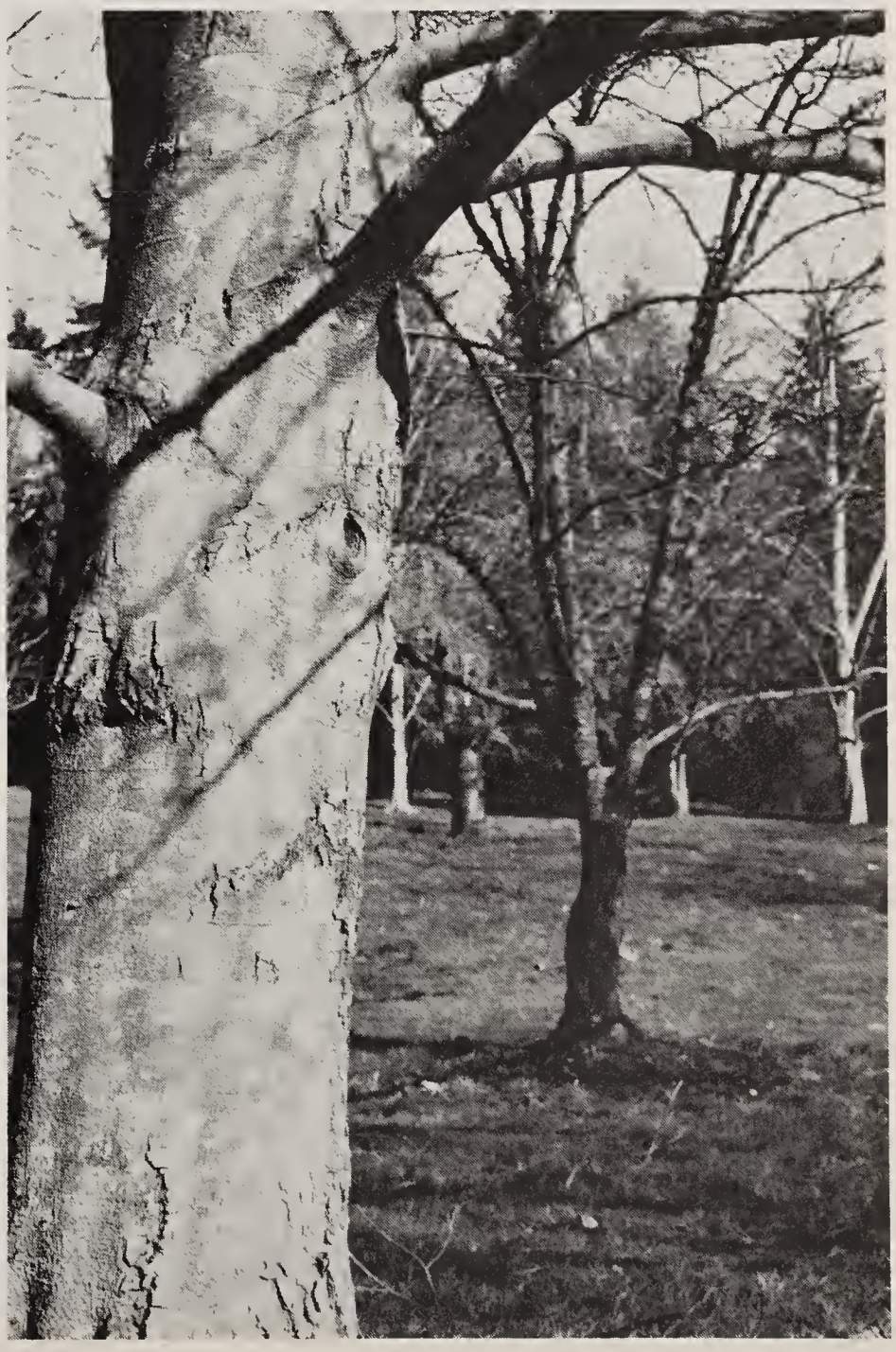
The cut-leaved form of our native alder (*Alnus rubra* 'Pinnatisecta') must also be mentioned. The original tree noticed was recorded by T.J. Starker, who found it on a farm at Hillsboro, Washington County, Oregon.[2] Seeds were sent to our Arboretum in 1940 by Oliver Matthews of Salem, Oregon, who probably had obtained them from Mr. Starker or from the same farm.

Breeding studies conducted by Boyd Wilson, of the Department of Natural Resources, Olympia, and Professor R.F. Stettler of the College of Forest Resources, University of Washington, have shown that the 'Pinnatisecta' form is due to a recessive gene in homozygous condition. Thus, 'Pinnatisecta' seedlings are best produced by crossing two 'Pinnatisecta' trees.

Foliage and fruits of the smooth alder, *Alnus serrulata*. Photo: B.O. Mulligan

In the early spring of 1951, Lauri Karki, a student in the then College of Forestry at the University, grafted scions of 'Pinnatisecta' taken from a tree or trees on Foster's Island onto seedlings of *Alnus rubra* in the Arboretum greenhouse. There are still two trees of 'Pinnatisecta' on Foster's Island, one of which is 45 feet in height. (The second tree is dying and has lost most of its branches.) These speci-

The smooth trunk of white alder, characteristic of American and European species. Photo: B.O. Mulligan



[2]Starker, T.J. 1939. Journal of Forestry 37:415.

mens presumably arose from some of the seeds sent by Mr. Matthews in 1940, although there is no record of their origin or planting date in our files. From the grafts made by Karki four plants resulted, of which two were planted in the collection west of Azalea Way in April 1955. One of these was destroyed by an errant automobile in April 1968 when 30 feet tall, the other has now reached 46 feet after 26 years. The other two were placed on the north side of Honeysuckle Hill, west of Azalea Way and north of the true ashes and viburnums; one 48-foot individual now remains.

The leaves of the unusual form 'Pinnatisecta' have seven to ten pairs of lobes and are usually divided for about two-thirds of the distance to the midrib, or especially in the smaller leaves, completely to the midrib. There is also another tree of this form, acquired in 1978 when growing in the Lake City area of Seattle. The leaves of this are less deeply lobed than in our original trees. This specimen currently resides in the nursery. The European species *Alnus glutinosa* and *A. incana* have both produced a number of different cut-leaved forms, said to be particularly common in Scandinavia.

Foliage and fruit of *Alnus cordata*, Italian alder.
Photo: B.O. Mulligan

European Alders

The Italian alder, *Alnus cordata*, is certainly one of the most attractive as well as one of the fastest-growing alders. The first tree placed in the Arboretum was obtained as a young plant from the Kohankie Nursery in Ohio in 1949; it was set out in the spring of 1951 on the flat area just over the footbridge to Foster's Island. Now considerably shaded by native cottonwood trees which have grown up behind it, it has attained 70 feet in height in those thirty years. Much better specimens are the two trees to be found on the slopes north of Rhododendron Glen. These trees were raised from seeds obtained by Professor P. Haddock, then at the College of Forestry in the University. One tree, planted in April 1954, is now up to 67 feet. These three trees all survived the 1955 freeze without damage, despite the fact that the species is native only to Corsica and southern Italy. There is another group of *Alnus cordata* located west of Azalea Way opposite the *Ceanothus* collection. These alders originated from seeds received in November 1964 from the Silvicultural Experiment Station, Firenze, Italy. Planted in March 1969 when already 10 to 14 feet tall, these trees are now smooth, gray-trunked specimens from 51 to 59 feet in height, having grown more than 40 feet in twelve seasons. They started producing cones in 1971 and 1972. Flowering time is in February. The glossy, serrulate leaves borne on slender stalks resemble those of the cultivated pear and are unlike those of any other alder. The leaves remain on the tree until December.

The common European alder, *Alnus glutinosa*, is represented here by no fewer than five different introductions. Only one introduction is known to have originated from wild seeds, from Poland in 1957. The others are all from arboreta or botanical gardens, the earliest being those from the Morton Arboretum and Kew, London, in 1946, which have already been mentioned amongst the earliest plantings on Foster's Island. In the main collection are two trees from the Polish seeds, three having been planted in March 1962 when eight feet tall, but one dying in 1969. The remaining two are now compact pyramidal trees 46 and 50 feet in height. Here also are two more raised from seeds received in 1958 from the V.L. Komarov Botanical Institute of Leningrad.

These two alders were planted in April 1961 when four to five feet tall; they are now both 52 feet in height. Finally, seeds received in 1964 from the Botanical Garden, Tbilisi, in the southern USSR, gave us two plants which were set out in the same area in March 1969 when already 17 feet tall; the largest has now reached 42 feet.

It would seem that under our conditions we can expect a growth rate of two feet per year or better from *Alnus glutinosa*, although one must admit that this species does not have any particular ornamental features to recommend it for local planting. However, there are two variants of *A. glutinosa* in our collection, one of which, 'Imperialis', can make a very distinctive and quite ornamental tree on account of its deeply cut, narrow leaves, much like those of the cut-leaved European beech, *Fagus sylvatica* 'Asplenifolia'. The variant 'Imperialis' came as a young plant from the former Boyce Thompson Arboretum at Yonkers, NY, in December 1950. It was placed in the main collection close to the creek, in April 1953. By December 1965 it was 27 feet tall and forming an attractive tree, but unfortunately it gradually declined in the late 1970's and was dead by April 1979. Fortunately, scions had been taken from it much earlier and grafted onto our native red alder. A young tree from this source was planted near the bank of the lagoon north of the Arboretum entrance, probably in 1958. By November 1981 it was 44 feet in height. The good form and very distinct foliage make this tree well worth further propagation and distribution.

The other variant of *Alnus glutinosa* involves the habit, not the foliage. 'Pyramidalis' is an upright form with broad, leathery leaves. It was grafted at the Arboretum in March 1950 from scions received from the Morton Arboretum. A young plant was set out on Foster's Island in November 1951 which survived for some years but eventually died from an unrecorded cause. Three more specimens of 'Pyramidalis' were planted at various times between 1953 and 1964 near the south end of Azalea Way; of these only one remains, close to the path leading down to the parking lot by Lake Washington Boulevard. This survivor is now 17 feet tall but evidently is diseased at the base of the two stems where a branch has been broken off.

Foliage and fruit of *Alnus glutinosa* 'Pyramidalis'.
Photo: B.O. Mulligan

The European gray alder, *Alnus incana*, was amongst those planted on Foster's Island in 1947, having been raised from seeds received from both Kew and the Morton Arboretum. None, however, survived to 1970. The only representatives of this species are two small plants of the form 'Ramulis Coccineis'. In this form the young branches are colored pale orangish tan. The male catkins, produced at the ends of the twigs, are only 1 to 1.5 cm long and are flushed rose or pink. This coloration is an unusual character, especially since the leaves show no purple pigmentation but are rather yellowish in summer. The two seedlings were raised from seeds received from a private garden in southwest England in 1951. They were planted out in 1955 close to *A. glutinosa* 'Pyramidalis'. Both plants exhibit the unusual color and catkin size, so the features are evidently inherited. The largest plant is now only ten feet in height; the second was dying in 1980 and did not survive 1981. There is another grafted plant in the grove of native alders just north of East Foster's Island Road; planted in

December 1974 it is now nearly six feet tall.

Until recently the shrubby European green alder, *Alnus viridis*, has not been very successful here. Seeds were received from the Royal Botanic Gardens, Kew, in 1945 and again in 1946, resulting in three and then one plants being set out on Foster's Island in 1947 and 1949 respectively. By January 1970 when a check was made of all the alders on the Island, none of these could be found, nor have they been traced since then. In March 1956 seeds were obtained from the Botanical Institute of the University of Grenoble, France. The single plant resulting from these also was placed on Foster's Island in December 1959, but likewise disappeared later without record of its passing.

The latest lot of seeds came from the Botanical Garden of Geneva, Switzerland, in March 1971; they had been collected in the canton of Valais in the southern portion of that country. Five plants were set out in the main collection of Azalea Way and close to the creek, in February 1979 when six to eight feet tall. By January 1982 most were eight to nearly nine feet tall with one up to ten feet in height, growing vigorously. In the fall of 1981 they all showed considerable scorching of their leaf margins, even though the location is unlikely to become dry even in summer. Perhaps some soil deficiency or pollutant in the atmosphere is the cause of this trouble; it remains to be seen whether the shrubs will recover.

Alnus viridis is native to the mountains of central and eastern Europe, from France, including Corsica, to the northern and western USSR, and south into Bulgaria and Rumania. The young shoots are brown and smooth and the buds are stalkless or on very short stalks like other members of this subgenus (*Alnaster*). The ovate leaves are wedge-shaped to rounded at the base, with margins both lobulate and serrate. The tapering cones, borne in clusters of three to five, are about 1 cm long. The flowers open in spring with the new leaves as do those of our native mountain alder, *A. viridis* subsp. *sinuata*.

Native red alders, beautiful in their white bark, crowd up to the roadsides along the Hoh River of the Olympic Peninsula, Washington.
Photo: B.O. Mulligan

Acer macrophyllum: Hills of Gold

*MARVIN E. BLACK**

Misconceptions die hard. I grew up in a Northwest logging town and learned to disdain *Acer macrophyllum* as a "weed tree." It made nice fancy turned-wood bowls. It was good firewood, but it had no use as a landscape tree. Mine was a typical western frontier attitude—no good can come of anything common.

First doubts about that conviction appeared when I began designing and creating gardens. My Willamette valley garden was small and summer-hot. A young bigleaf maple was the largest inhabitant, sharing the space with a host of exotics. It rubbed shoulders (or more aptly in the maple's case, ankles) with loquats, fatsias, black bamboo, *Ceanothus* and rhododendrons. The "hometown kid" looked special indeed—adequately bold and "tropical" to dominate this company. In autumn it was the only member of the group to manage a color change, to a gold that still amazes me. Still... it was a weed tree, and seedlings were everywhere.

Discovery by Europeans

Bigleaf maple was first sighted by Archibald Menzies with Vancouver's party on Protection Island at the northeastern tip of the Olympic Peninsula. "Besides a variety of Pines we here saw the Sycamore Maple—the American Aldar—a species of wild Crab and the Oriental Strawberry Tree." (Menzies' journal entry May 2, 1792, reported by Jones.) His botany was imperfect but his names were graphic—the bigleaf maple looks very much like the British sycamore maple, *Acer pseudoplatanus.*

Frederick Pursh published descriptions of plants from the Lewis and Clark expedition. Pursh "appropriated" much of Lewis's work; he published in *Flora Americae Septentrionalis* in 1814 the official description of *Acer macrophyllum* some nine years after Lewis saw the tree at "the Great Rapids of the Columbia" (probably the Gorge).

*Seattle City Arborist

When David Douglas saw the tree a decade after Pursh's description, he wrote in his journal: "*Acer macrophyllum,* of Pursh; one of the largest and most beautiful trees on the Columbia River. Its large foliage and elegant racemes of yellow fragrant flowers contrast delightfully with the dark feathery branches of the lordly pine. Correctly noted by Pursh to have the largest foliage of any." (How large are the leaves? Usually to 12 inches across, but the annual Maple Valley, Washington, Big Leaf Contest has had winners above 24 inches broad!)

Use by Native Americans

Douglas saw the tree through the critical eye of a foreign botanist. What of the local civilization, the Indians? Did they distinguish "weed trees?" We know that sometimes old trees were honored by the coastal Indians. One of the most noted of such trees was an old *Acer macrophyllum* north of Oregon City. It came to be called the "Pow Wow Tree" because weddings, dances, and other important ceremonies were held beneath it. The old tree stood on the bank of the Clackamas River on part of Peter Rinearson's donation land claim. It is still clinging to life in 1982, and is probably over two centuries old. A plaque on the tree notes that the first Oregon State Fair was held beside it in 1861.

Indians from southern California to northern British Columbia (the tree has not been found to grow in Alaska), used the wood for smoking meat and fish. The giant leaves made work surfaces for food preparation and served as "lids" in cooking. The leaves were also placed in steaming pits to flavor cooking meat and were used as a base to dry berries. The bark was made into rope, the wood into various implements, or decorations, or canoe paddles. *Acer macrophyllum* was not much of a food plant, but on occasion the cambium was dried in criss-cross strips for winter or eaten in small

quantities with oil, because it was constipating. "It made one thin to eat too much." Sometimes the young maple shoots were eaten raw, and sometimes the boiled, sprouted seeds were eaten (Turner, 1975). The sap is noticeably sweet—the early settlers sometimes made maple sugar from it. At Seattle's Woodland Park Zoo, when spacious new outdoor habitat areas were made for the apes, a large old bigleaf maple in the encolsure was girdled by one of the animals chewing through the bark to reach the sweet sapwood.

In the West, where few hardwoods are used for furniture or cabinetry, bigleaf maple and red alder are the two most important. Birdseye maple, beautifully figured wood from burls low on the trunks of *Acer macrophyllum,* is prized. The wood of the tree was commented upon by Douglas—"the wood soft but beautifully veined"—and Nuttal: "the wood is whitish, and resembles our curled maple" (Torrey and Gray, 1840). W.J. Bean comments (1914) "The timber is highly valued in N.W. America for furniture and indoor work—more so than that of any other tree of those regions except conifers." Saunders (1914) adds "The timber possesses qualities valued by builders, who put it into the hardwood floors of many a Pacific coast bungalow." For the Indians it was one of the basic construction timbers (Palmer and Stuckey, 1977).

Names of Acer macrophyllum

The preferred name of the tree is bigleaf maple, but there are alternates. In Oregon and usually in England the tree is called Oregon maple, the American authority Alfred Rehder preferred this name, and Abrams recognized it. George B. Sudworth, noted dendrologist, wrote in *Forest Trees of the Pacific Slope* that the name broadleaf maple "seems preferable" and a few authors follow this lead. L.H. Bailey and Helen Gilkey preferred the variant, largeleaf maple. The tree is also called white maple by Peattie, common maple by Hitchcock, British Columbia maple in Canada, and longleaved maple in Johnson's *Gardeners' Dictionary,* a landmark 1846 work. Californians sometimes call it canyon maple (Schmidt, 1980).

Horticultural Uses

When I arrived in Seattle, I found bigleaf maple branded somewhat of an outlaw. Early settlers brought the tree from the woods to use on the streets in front of their houses. Old Seattle photos from 1880 onwards picture this tree often planted, and it is regularly spaced on many Capitol Hill streets. The trees did not make good street trees (beware of any literature that recommends them as such. . .), for they broke up the young city's sidewalks with their shallow, powerful roots, and sought out sewers. The city fathers early banned the tree from street planting by ordinance, so—if I chose—I had legal backing to crusade against my "weed tree!"

I was having second thoughts, however, about this tree's value, once it was growing away from concrete paving and loose-tile sewer lines. *Acer macrophyllum* is a survivor, enduring poor and wet soils where other trees will not grow, and Seattle has many such hillside sites. Its heavy mat of roots (tricky to garden under, they compete fiercly for food) helps hold hillside soil surfaces against beating autumn rains. In its spring growth, the tree sponges up tons of water from wet soils. The tree is tolerant both of lean, soggy, gravelly soils, and of Californian summer droughts. At one time I had classed *Acer macrophyllum* as short-to-medium in longevity. Not so, for it is long-lived. Besides the two-century Pow Wow Tree there is a bigleaf maple at English Camp on San Juan Island claimed to be more than 300 years old (Randall and Clepper, 1976). Sudworth calls it "Long-lived, the largest trees attaining an age of from 150 to 200 or more years. Forest-grown trees, from 12 to 20 inches diameter, are from 50 to 85 years old." It certainly is large enough to tower over a tiny house and frighten one in a storm—a statement equally true of many other large often-recommended trees—but as a backdrop, screening, or hillside tree it has very good potential. It is routinely vigorous, with husky foliage of a vibrant summer green. The number of local nurseries stocking this tree continues to increase; there seems to be a growing demand. It shows up increasingly on all sorts of landscape plans that come across my desk for review.

Recently I was comparing notes with two respected and able local arborists, discussing a hillside-full of *Acer macrophyllum.* Good

tree or bad tree on this hillside? I had arrived full circle, I was arguing its merits, my colleagues countered "weed tree!"

For the first time I ask, "Why do so many people dislike bigleaf maple?" Is it because all the earlier garden books downgrade it that "this native maple has not yet achieved the popularity it deserves". . . (Schmidt, 1980)? (These books were written primarily on the east coast, where all agree it cannot be grown well.) Is it the local lack of respect for anything that grows so well, that pops up where no one invited it?

I know that *Acer macrophyllum* is one of the featured trees shown to visitors in a botanic garden outside Paris, that English arboreta prize this tree, that a Norwegian landscape architect visiting Seattle raved to me about its landscape appearance. Last October Frank Santamour from the National Arboretum in Washington, DC first saw the Northwest hills full of bigleaf maples in fall color. He viewed the tree in Seattle, in the Olympics, on the Oregon coast, clinging to lava cliffs in the Columbia River Gorge with sagebrush at its feet, and he said "Why aren't you people doing anything with this tree in your cities?" (Frank is a geneticist dedicated to seeking better trees for urban stresses.)

So I approach the literature, to see our local weed tree as others (and our own writers) see it. The ratio of positive-to-negative comment runs about 20 to 1. It finally becomes a jury's verdict:

". . . It is a magnificent tree and must be very beautiful in cultivation." (Macoun, 1883.)

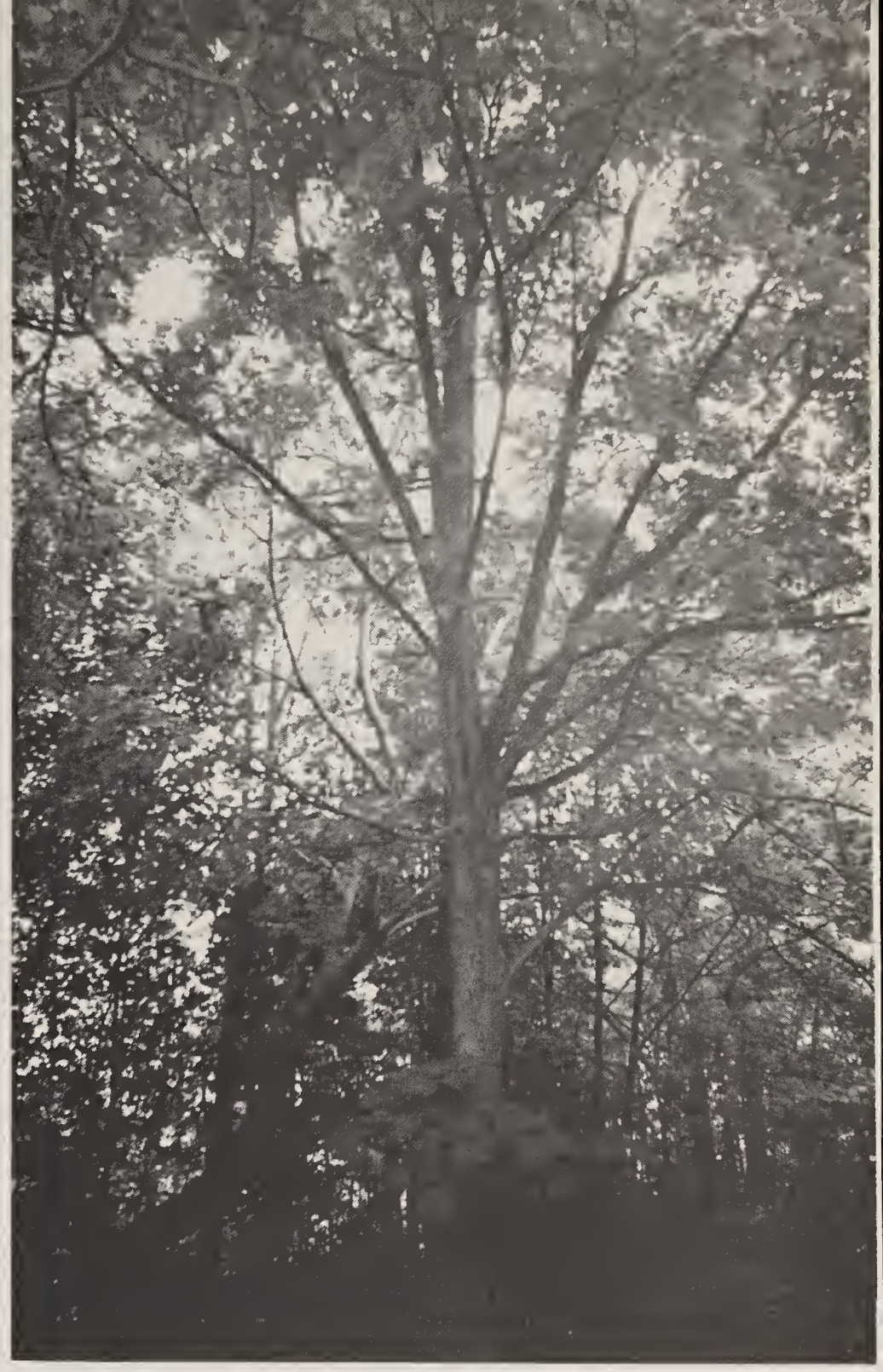
". . . remarkable for its large leaves turning bright orange in fall." (Rehder, 1927)

". . . much planted as a shade and ornamental tree, for which it is well suited." (Metcalf, 1959)

". . . the best (maples) are . . . for handsome substantial foliage *A. macrophyllum* . . ." (Hora, 1981)

". . . a very popular tree on the Pacific coast, where it thrives. Its unusually large leaves make it an excellent shade tree, and they turn a bright yellow to orange in the fall." (Wyman, 1951)

". . . Our native Oregon maple is conceded by many authorities to be one of the finest species, with its handsome large leaves turning yellow in the fall, and its lovely hanging clusters of chartreuse flowers in the spring." (Grant, 1943)



Acer macrophyllum **in its natural setting.**

". . . in many respects it is the noblest of maples, and it thrives well in the British Isles . . . Owing to their hairiness and the great size of the wings, the fruits are particularly striking." (Bean, 1914)

". . . an elegant tree, forming a tall narrow dome, it is best in a somewhat moist atmosphere, as near the sea or a lake." (Barber, 1975)

". . . One has come to expect the west coast to produce something bigger. In maples it is the leaves. The tall-tree maple of the west coast is the bigleaf or Oregon maple, which has whoppers. In the Pacific forest, where broadleaved trees are far outnumbered by conifers, the foot-wide foliage of the bigleaf stands out everywhere. In autumn when it is yellow or orange a single leaf shuffling to the floor among the dark fronds of Douglas fir is an incident worth watching." (Johnson, 1973)

". . . There is not a finer part of the world than

the country around Puget Sound and the lower gorge of the Columbia River . . . and here it is that this noble Maple is at home. You see it lining the roadsides, growing in the streets of small towns and the dooryards of farms, following the windings of the clear cold streams, crowding the islands with its great domes of foliage. Nor could there be a finer shade tree than this . . . Then, in autumn, they turn color. The hue in the Pacific Northwest is a brilliant orange-yellow. In California it is a pale yellow, but even there it is a lovely note, translucent and, when the sunlight comes slanting through the mighty Redwoods overhead, almost angelic." (Peattie, 1950)

Actually, I never realized my sister was beautiful, either, until I heard it from a stranger.

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Ptychoverpa bohemica. **Photo: D.E. Stuntz**

The Morel of Early Spring

A sign of spring in the fungus world is the early or Bohemian morel, *Ptychoverpa (Verpa) bohemica*. Many hunters of edible fungi start the season each year by searcing for this tasty fungus. They go out when the buds of the cottonwood, *Populus trichocarpa*, burst open and the aromatic fragrance from the bud scales and the foliage is wafted on the air. They search in groves of cottonwood and other hardwoods, in damp places.

Ptychoverpa bohemica is one of the false morels in the group of cup fungi (Ascomycetes). The uninitiated hunter should beware,

since the Bohemian morel can be confused with the toxic elfin saddle (*Gyromitra infula*) or other undesirable fungi.

The long stalk of *Ptychoverpa* is creamy-white, three to five inches tall, and topped by a thimble-shaped, wrinkled brown cap. The cap hangs like a skirt on the stalk, and is not attached to the stalk at the margin.

In general, any edible member of the cup fungi should be cooked thoroughly, preferably parboiled and then fried, before being eaten. Furthermore, the Bohemian morel does affect some consumers adversely, so a very small amount of it should be tasted at first.

There is consolation for those who do not feel sufficiently experienced to identify this wild mushroom. One can take a spring stroll in the stands of budding cottonwoods, enjoy the "thrill of the chase" and perhaps the excitement of discovery, then just absorb the strange beauty of this fungus. (This is the "morel" to which Carol Slocum refers in her *lessons from the fungi*.)

DO NOT USE THE DESCRIPTION OF THIS FUNGUS AS A BASIS FOR IDENTIFICATION OF ANY FUNGUS YOU INTEND TO EAT. There are field guides more appropriate for this purpose, and expert help is available from the Puget Sound Mycological Society, 362-7402.

SUSAN LIBONATI-BARNES

lessons from the fungi

go quietly into the forest. . .
walk a ways in.

then—
sit down on a log
and
do nothing.

talk gently with a friend,
idle talk that doesn't even want to go anywhere.
try to accomplish nothing.
do not search.

If you manage this,
from the leaf litter will appear
morels,
the dark greens of the third kingdom.

they are moist,
tasting of earth and fleshy delight.
most people want to find them to eat them.
I just like to find them and look.

I finally learned more than beauty from them—
I learned to let them find me.

(I try to remember this
when caught up in the race to fame.)

CAROL J. SLOCUM

Book Reviews

RHODODENDRONS OF CHINA, Species descriptions and key from Volume III, *Iconographia Cormophytorum Sinocorum*, Beijing Botanical Research Institute of Academia Sinica. Translated from the Chinese by Judy Young and Dr. Lusheng Chong. 1980. Published by Binford and Mort, Portland, Oregon, on behalf of the American Rhododendron Society and the Rhododendron Species Foundation. 670 pages, with the numerous original illustrations. Hardcover. Price: $18.00.

Although new rhododendron knowledge often circulates slowly, a chain of fortunate circumstances speeded the preparation of this book. In a multivolume work on native plants, Chinese botanists included a major section on rhododendrons. Published in 1974, this volume combined their own observations with those of foreign plant hunters and botanists, and it attracted the attention of Dr. August Kehr during his 1977 visit to China, with others from the US Department of Agriculture. Upon his return, Dr. Kehr reviewed the volume for the Spring, 1978 issue of the American Rhododendron Society *Bulletin*. There, it came to the notice of Judy Young, a serious student both of rhododendrons and of the Chinese language, who was planning a trip to become acquainted with the plants and botanists of Taiwan. Although aware of other volumes concerning the native plants of China, she had not seen the one which included rhododendrons. She was immediately interested and with Dr. Kehr's encouragement accepted the challenge of translation, completing the job in time for publication in 1980. (To start, Young received training in Chinese language from Dr. Lu-sheng Chong, who also translated part of the volume; later, she worked nearly independently.)

Learning of this book, people ask the following questions:

Did the Chinese botanists adequately describe and correctly name their species?

When classifying the species into affinity groups, did they follow a system recognized in this country?

Did their approach and their conclusions resemble those of botanists in other nations?

Did the translator bring the book to life in English?

Judging the work of the Chinese authors through the lens of translation, their plant descriptions seem fairly thorough, about equal to recent ones from the Edinburgh botanists but less comprehensive than those by the Philipsons in their 1975 revision of the Lapponicum rhododendrons. (See *Notes Roy. Bot. Gard. Edinburgh*, 39:1 and 34:1.) Geographical and habitat information appended to the descriptions is at least of average quality. But absent are references to literature, synonymy, and lists of specimens—all of which will perhaps appear in a subsequent publication. Moreover, some species are omitted, apparently by intention.

Concerning botanical credibility, we know that the information came from Beijing (Peking) Botanical Research Institute, of Academia Sinica, and that the principal contributor was Professor R.C. Ching, a reputable botanist chiefly known previously for work on ferns. He and the other authors had the obvious advantage of working in their own country. They knew where to locate herbarium specimens, they were familiar with the geographical and ecological barriers delimiting species ranges, and they may have been able to supplement their herbarium work with field observations.

To compare some of their conclusions with those recently published by Dr. James Cullen (in *Notes Roy. Bot. Gard. Edinburgh*, 39:1), I selected Section Pogonathum (the former Series Anthopogon). For this section, the Chinese list eleven species in their key and fully describe nine in their text. Of the eleven, Cullen recognizes eight as species and two as subspecies, placing the other one in synonymy. In such cases of difference in taxonomic opinion, either side may eventually win the support of peers and resolution of the difference is facilitated by such scrupulous translation work as we see in *Rhododendrons of China*.

Two features often found in works of this kind are distribution maps and illustrations. *Rhododendrons of China* contains no such maps but does contain lists of species by provinces and by more specific locations. There are full-page drawings of all species described. These are attractive; most are lifelike and moderately well detailed. The recent Edinburgh work, by contrast, includes distribution maps but no illustrations.

The Chinese botanists, publishing in 1974, used Dr. Sleumer's classification system—today almost universally accepted, but at that time known to few people in English-speaking countries. In Great Britain, the new-generation Edinburgh botanists were also quick to recognize the merits of this system. Thus, we see that the Chinese occupy a respectable position at the leading edge of rhododendron studies.

Now comes the final question, concerning quality of translation. The answer, I think, is that Judy Young fully and brilliantly realized her objectives. To do this, she obtained scientific and language assistance and with the collaboration of Dr. Lusheng Chong prepared a Chinese-English and Chinese-Latin glossary of the necessary vocabulary. She was able to concentrate on translation, since a Publication Committee, led by Karen Gunderson and Kendall Gambrill, handled most of the financial administration, fund-raising, publication arrangements, and day-to-day problems of coordination and communication. Nevertheless, the final stages of bookmaking required Young's attention as well as theirs.

The result, in my opinion, is one of the dozen or two essential rhododendron books of this century. It is also a bargain, a language handbook for the botanical traveler in China, and a thing of beauty.

Three changes might be suggested for the next edition: running heads at the tops of the pages, specifying which rhododendron sections or subsections are described in the text below; inclusion of the now-available English translation of the original Sleumer botanical key, side by side with the translation of the Chinese version; and the printing of the author's and translators' names on the spine of the book. (This, at least, would keep people from thinking it was written by publishers Binford and Mort.)

FRANK DOLESHY

CALENDAR OF EVENTS

Arboretum Foundation:
Board of Directors June 9
(Annual meeting and dinner)

Unit Council:
Governing Board June 3

No further meetings are scheduled until September.

Most study groups meet irregularly in the summer. For regular times, the reader is referred to previous issues of the *Bulletin*.

EXPLORER'S WALKS are scheduled for June 8 and 23, July 28, and August 25.

SUNDAYS IN SPRING: SUNDAYS AT ONE, public tours on June 6 and 13.

FREE PUBLIC LECTURE: LEGUMINOSAE IN THE ARBORETUM, June 16.

NOHS TENTH ANNUAL FERN SALE, June 25, 10 AM—9 PM, June 26, 10 AM—4 PM
Crossroads Mall, Bellevue

NATIVE AMERICAN WEAVING EXHIBIT, opens in July at the Burke Museum.

FIFTH ANNUAL NATIVE PLANTS, NATIVE AMERICANS EXHIBIT,
June 1—6, Burke Museum

BONSAI SHOW, June 4—6, Burke Museum

FOURTH THURSDAY WEEDERS' DAY, June 24, July 29, 10AM

For further information, consult Events of Interest, this *Bulletin*, or call 325-4510.

THE LARGER SPECIES OF RHODODENDRON, by Peter A. Cox. B.T. Batsford Press Ltd.,, London, 1979. 352 pages, 53 black-and-white photographs, 6 color plates. Price approximately $45.00

Those who have read Peter Cox's earlier book, *Dwarf Rhododendrons*, will be gratified by this recent publication that covers the balance of rhododendrons, as known to date, excluding the Malesian (Virya) species. Together, these books provide a thorough knowledge of the genus. In the present work, Mr. Cox has arranged the species according to the new classification system of subgenera, sections and subsections, replacing the old system of series to which we are accustomed. As an aid, the names of the series are included in brackets.

The ecology of the genus *Rhododendron* is well covered, beginning with the history of rhododendron evolution and distribution throughout the world, and including the fascinating theory of continental drift. Mr. Cox lists the localities and growing conditions of species throughout the world. As a collector of some plants and a student of others, he provides a delightful description of their beauty and of the thrill of discovering them in their native habitats. This is followed by an evaluation of species in general for garden merit, details of their care, cultivation and use in landscaping, and even tips on showing.

The heart of the book is given to descriptions of all the species considered "larger", that is, averaging more than 1.5 meters in height. The descriptions are much easier to understand and absorb than in most handbooks, and each one gives the native location as well as advice regarding garden value. Hardiness and susceptibility to wind damage are the chief points used in determining location in the garden, and the last chapter is devoted to a thorough discussion of propagation and care. General cultural information is provided in many books, but Peter Cox has expanded on this subject, drawing upon his own wide experience and bringing us the most modern of techniques and materials. A final section contains a valuable list of his gardening recommendations, considering plant form, flower color and climatic limitations. While this may sound like a textbook, Mr. Cox's enthusiasm for the rhododendron and his beautiful writing make it a hard one to put down.

The fine black and white photographs demonstrate the great beauty of leaf and form in these mostly large-leaved species. The line drawings are most helpful in the descriptions, as are the lovely color plates, all by Margaret Stones. My only criticism is a physical one—the binding does not seem stout enough for a book that will be so heavily used as a reference. This is minor, of course, and any rhododendron buff, whether expert, novice or somewhere in between, would be delighted with this treatise and happy to take special care in handling such a treasure.

E.B. DUNN

Classes of Interest

Urban Horticulture—Arboretum Courses

Washington Park Arboretum is open to the public for education and recreation. Courses are offered through the Center for Urban Horticulture, College of Forest Resources. Preregistration is required. Classes fill rapidly, so register early. For course registration information, telephone 545-1373. To register, send check or money order with your name, address, and daytime telephone number to: Arboretum Courses, Anderson Hall, AR-10, University of Washington, Seattle, WA 98195.

HOME FRUIT GROWING. Visit the open house at Western Washington Research and Extension Center at Mount Vernon during its summer open house. See the current results of research in strawberry and raspberry culture and in vegetable tunnel experiments. The container-culture fruit trees will just be ripening (a must-see for urban gardeners!). Visit with Dr. Robert Norton and the WWREC staff. Friday, July 16, 1982, 9:30 AM—3:00 PM. Bring your own lunch. Fee of $10.00 includes transportation. Enrollment limited.

THE BEAUTY OF SUMMER COLOR. Don't miss this special summer trip to Butchart Gardens where W.H. Warren, noted horticulturalist, will guide us through colorful masses of summer annuals. This trip is designed for persons interested in learning about using summer color in their landscapes. Bring your lunch or buy one on the ferry or at the Garden. Fee of $35.00 includes transportation, ferry from Tsawwassen and garden entrance fee. Saturday, August 21, 1982, 6:30 AM—9:00 PM. Enrollment limited.

SUMMER PRUNING OF ORNAMENTALS. Lecture-demonstration at the Arboretum led by Chico Narro. Learn corrective pruning methods, how to keep trees from "getting out of bounds," how to control water sprouts (spring growth), which trees "bleed," and how to control form (hedges). Wednesday, July 21, 1982, 7:00—9:00 PM. Fee: $7.50

SUMMER CUTTINGS. Lecture-demonstration on propagating plants from summer cuttings. Taught by William Halstead, this course will stress equipment, methods, and materials. Learn which plants respond to summer propagation. Plants and materials will be furnished, or bring your own. Wednesday, July 14, 1982, 7:00—9:30 PM. Fee $10.00.

NEW AND UNUSUAL WOODY PLANTS. A field course designed for professionals in the nursery trade, landscape architects, designers, grounds maintenance personnel, or others by instructor's permission. Taught by Joseph Witt, you'll become acquainted with the newer, little-known plant introductions and how they can be used in Northwestern landscapes. Saturday, July 24, 1982, 10:00 AM—4:00 PM. Bring your own lunch. Fee $17.50. Enrollment limited.

THE LIFE IN A WESTERN WASHINGTON BOG. Don't miss this field trip to a pristine bog—Kings Lake—in the foothills of the Cascade Mountains. Led by Jan and Giacomo Pirzio-Biroli, it's an opportunity to study succession in bogs. For background information, see "Kings Lake Bog," *Arboretum Bulletin* 40(3):14, 1973, by Betty Jo Fitzgerald. Bring your camera, lunch, and waterproof gear. Fee of $10.00 includes transportation. Saturday, June 26, 1982, 9:30 AM—3:00 PM. Enrollment limited.

University of Washington Continuing Education

Continuing Education at the University of Washington will offer a variety of courses this summer that should be of special interest to Arboretum members and their friends. They are open to all interested people. There are no academic requirements, no tests and are taught by faculty who enjoy teaching adults. SPECTRUM, the quarterly journal of Continuing Education, describes these courses and hundreds of others (both credit and noncredit), has complete registration information, and is yours free by telephoning (206) 543-2590.

WILDFLOWERS ON MOUNT RAINIER, a weekender, July 16-July 18. This is being held at the peak of the blooming season. Participants will stay at Alexander's Manor, a restored country inn and a gourmet's delight. Instructors are Dr. Virginia Dale Adams, ecologist, and Research Associate, College of Forest Resources; and A.B. Adams, doctoral candidate and plant ecologist. Fee of $98 includes accommodations, food and transportation.

TWO YEARS LATER: LESSONS FROM MT. ST. HELENS, a Saturday program, July 31, coordinated by Anthony J. Irving, Research Associate, Geological Sciences, who has assembled a faculty who are all actively involved with Mt. St. Helens in their area of speciality. Fee $25.00.

NATURE PHOTOGRAPHY: OLYMPIC MOUNTAINS, June 18-20, at Peninsula College, Port Angeles. James O. Sneddon, literally the dean of campus photographers and now coordinator of special media projects, is the instructor. There will be a critique session of the photos you take on Tuesday evening, June 29. Fee $98.

MAKAH NATION: HERITAGE AND CULTURE. The history of this whale- and seal-hunting tribe, from the earliest times to the present, will be discussed in preparation for a one-day visit to the lavish Makah Tribal Museum at Neah Bay. The instructor is Greig Arnold, Director of the Makah Cultural and Research Center. The course, 4 sessions, will be held on Wednesdays, June 30-July 14, and Saturday, July 24. Fee: $48.

EDIBLE WILD PLANTS OF WASHINGTON, Saturday, July 24, begins with a lecture/slide presenta-

tion followed by a field trip. Professor Bastiaan Meeuse, botanist, is the instructor. Fee: $25.

THE HISTORICAL CAMPUS: AN ENVIRONMENTAL WORK OF ART, lecture/discussion series, has been coordinated by Polly Dyer, C.E. Director for the Institute for Environmental Studies. It will be held on five Tuesdays, June 29-July 27, and is planned to take advantage of long summer days to walk through and learn the history, as well as the artistry, of the campus. Fee: $25.

PAINTING WORKSHOP: THE CAMPUS IN WATERCOLOR, scheduled for 10 Wednesdays, 4-7 PM June 28-August 31. Laura Pizzuto, M.F.A. is the instructor. Fee of $65 includes materials.

A PLACE IN THE COUNTRY, a lecture series with Professor David C. Streatfield of Landscape Architecture, on seven Thursday evenings, July 1-August 12. He will explore the English Country House socially, economically, culturally. Lectures will be richly illustrated by color slides and enhanced with music. Fee: $35.

POWER FOR THE 80'S: ENERGY ALTERNATIVES IN THE PACIFIC NORTHWEST is a seven-session lecture series, Tuesdays, June 22-August 3, coordinated by Professor Philip L. Bereano, Program in Social Management and Technology. A distinguished faculty will explore conservation policies, political organizing related to public power issues, actual case studies of alternative energy projects and interesting new technology. Fee: $35.

MT. RAINIER: GEOLOGY AND PLANT ECOLOGY, a weekender, August 13-15. Participants will stay at The Lodge near the Nisqually entrance to Mount Rainier National Park and dine at Alexander's Manor, a gourmet's delight. Anthony J. Irving, Research Associate, Geological Sciences, and Virginia Dale Adams, Research Associate, College of Forest Resources, are instructors. Fee of $98 includes food, lodging and transportation.

BEACHES OF THE PACIFIC NORTHWEST, a seven-session evening class on Wednesdays, June 30-July 28, will be held both on and off the campus. On-campus lectures will be enhanced by a guided tour of the Seattle Aquarium, a morning field trip to a local beach and an all-day excursion to the rugged Deception Pass area. Hans Hartmann is the instructor. The fee of $47 includes the two field trips.

TRIP TO THE STARS: GOLDENDALE OBSERVATORY, is another weekender, July 16-18 with Professor Woodruff T. Sullivan, III, Astronomist, as the leader. The fee of $50 includes transportation to and from Goldendale. You will be helped with lodging arrangements in Goldendale.

Pacific Science Center School for Science

The Pacific Science Center features many courses for adults and young people. To register and to receive information about these and other classes, call 625-9333.

SUMMER SCIENCE CAMP at YMCA Camp Orkila on Orcas Island. Three sessions for children 10-13 will combine the fun of camping with science activities such as investigation of fresh and salt water ecology, telescope observation of the skies, identification of local plants and wildlife, and instruction on map and compass use. July 12-19 ($264), July 19-24 ($198), July 24-30 ($231).

DISCOVERING SEATTLE'S NATURAL PLACES, a day camp for 9-12 year olds, will visit such local natural wonders as the Aquarium, the Locks, and parks in the area. August 23-27, 9 AM—3 PM, including one overnight at Camp Long in West Seattle.

SCIENCE HALF-DAY CAMP for 6-8 year-olds, at Pioneer Park on Mercer Island. Camp meets from 9:30 AM—12:30 PM. The week of July 19-23 features general science; the week of July 12-16 features marine education.

WHALES AND DOLPHINS, for ages 6-8. Take a brief, exciting look at whales and dolphins, their physical adaptations, methods of communication, social behavior, and our attempts to save them from extinction. Instructor: Beth Whitehead. Fee: $9-12. June 12, 10 AM-noon.

FOUR-DAY RAFT TRIP TO GRANDE RONDE RIVER CANYON, for ages 16-adult. This raft trip through northeastern Oregon features a natural history tour of the area, and some moderate rapids on the river. Instructor: Norm Hogg. Raft trip only meets from July 7-10, fee $330-375. Package including travel meets July 6-11, fee $450-550.

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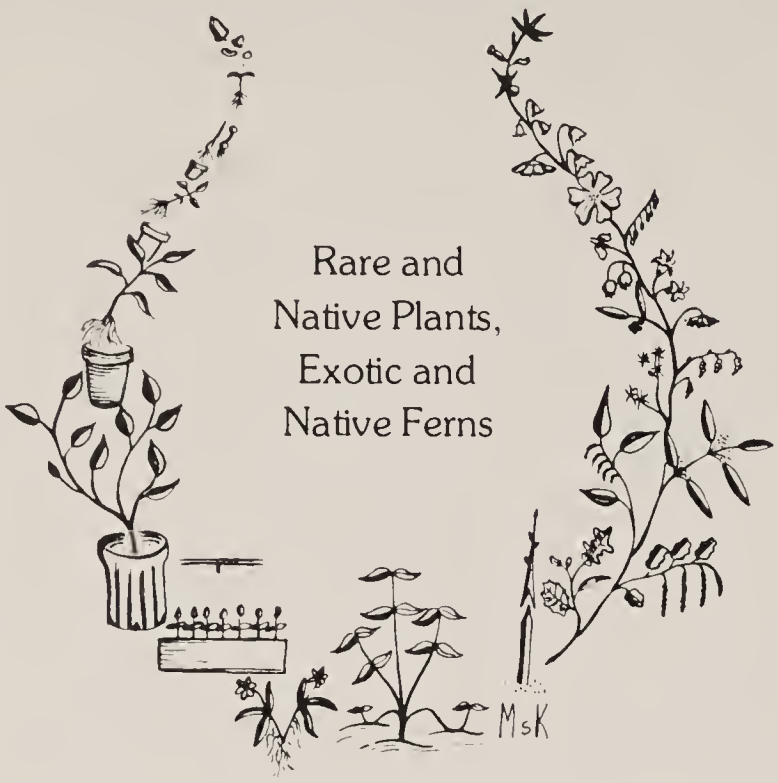

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INTERESTED IN A FALL TOUR OF KOREA?

The Center for Urban Horticulture and the Washington Park Arboretum are now planning a 21-day horticultural/botanical tour of Korea, to be led by J.A. Witt, Curator of Plant Collections. Tentatively, it will start in mid- to late September in order to see autumn color.

Arrangements in Korea will be made by Mr. C.F. Miller, owner of the Chollipo Arboretum and an authority on Korean horticulture. He is planning trips to areas seldom visited by westerners.

If you are interested, please call the Arboretum office, (206) 543-8800, or write to The Washington Park Arboretum (XD-10), University of Washington, Seattle, WA 98195.

Join the Explorers' Walks, meeting at 10 AM, June 8 and 23, July 28, and August 25, in the Arboretum Administration Building Parking Lot. PLEASE WEAR ADEQUATE FOOTGEAR, even in warm weather.